MUNICIPAL ENGINEERING

VOLUME XXXVIII. JUNE, NINETEEN HUNDRED TEN. NUMBER SIX

TOWN SCAVENGING AND REFUSE DISPOSAL.

UTILIZATION OF HEAT FROM REFUSE DESTRUCTION.

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THE Utilization of Heat Generated by Refuse Destructors by Its Conversion Into Energy. It has already been stated that the best uses to which the steam generated by destructors can be put are the pumping of a town's water or sewage, or for electric lighting or traction, as for these purposes the power will be required almost continuously throughout the whole twenty-four hours. At many works throughout England the steam generated is being used with good results for one or other of these purposes, and in order to show the saving which can be effected by its use, the author proposes to give a general description of the results obtained at some of the larger towns and Metropolitan boroughs.

In the city of Liverpool about 600 tons of refuse are dealt with per day. The steam generated is employed in the Corporation's power house in connection with the electric tramway undertaking. Between thirty and forty cars are sent over 100 miles of track each day solely by means of power derived from the steam generated by the destructors. Mr. Brodie, the city engineer, estimates that every ton of refuse delivered into the destructors is worth about one shilling and two pence for steam raising purposes.

At Rotherham a part of the heat generated by the burning of the refuse is utilized to raise steam for driving an air compressor which is used to work the ejectors employed to raise the sewage from certain low lying parts of the town. The remainder of the steam is passed to the electricity generating station. In many places clinker crushing machinery, and brick and slab making plants are driven entirely by the steam generated by the burning of the refuse, and in some instances the waste steam after it has been used for these purposes is still further employed in connection with steam disinfectors. There are many makes of these upon the market, but perhaps the best known are those of Messrs. Goddard, Massey & Warner, Ltd., and Messrs. Manlove, Alliott & Co., Ltd. The principle is the same in both designs, and consists of the introduction of steam under regulated pressure into a specially constructed aparatus. The machines are used for disinfecting the clothing and bedding, etc., of people who have been suffering from infectious diseases.

At Cambridge the whole of the town's sewage is pumped by means of steam generated at the destructors, which comprise six cells working in connection with three Babcock & Wilcox boilers. The quantity dealt with amounts at times to as much as 7,000,000 gallons per day, and the lift is fifty-two feet, the pumping engines developing 140 indicated horsepower. The steam generated in connection with the destructors of the Metropolitan Borough of Hackney is transferred to the electricity department. The statement of accounts for the year ended 31st March, 1908, showed that 38,308 tons of refuse were dealt with at an average rate of 124.4 tons per day. The amount of water evaporated per pound of refuse was 0.856 lbs. and the steam utilized by the electricity department totaled 73,464,675 lbs. For this the sum of 2,288 pounds, 1 shilling 3 pence was received by the public health department. In addition to this the sum of 62 pounds, 11 shillings, was realized by the sale of tin cans and residuals. The total cost of destroying the 38,308 tons amounted to 5,297 pounds 15 shillings, to which must be added

2,733 pounds 3 shillings 7 pence, being the repayment of principal and interest, so that the net cost of destruction, after crediting the value of the steam transferred to the electricity department and the sundry receipts amounted to 5,680 pounds 6 shillings 4 pence, or 2 shillings 11.6 pence per ton.

Combined Destructor and Electricity Station of the Borough of Fulham. The metropolitan borough of Fulham constructed their combined destructors and electricity works in 1901. There are twelve destructor furnaces of the standard Horsfall type, each having a grate area of 30 square feet, arranged in two groups of six each in two rows of three each, placed back to back. Between the two groups of cells are placed six Babcock & Wilcox boilers, each provided with Vicker's mechanical stokers electrically driven. The destructor gases are led into each of the boilers by means of an opening in front of the bridge, the flue to this opening being provided with a suitable damper, so that the boiler may either be heated from the destructor, or be fed with coal. Provision has also been made for firing the boilers by hand, in the event of interruption in the working of the mechanical stokers. Forced draught has been applied to each boiler. The refuse is fed into the destructor furnaces through charge openings on the tops of the blocks of cells. It is very roughly screened with a view to sorting out tin cans, etc., before it is put into the furnaces. The destructors are capable of dealing with ten tons of refuse per cell per twenty-four hours, and for every pound of refuse burned about 1½ pounds of water are evaporated. The forced draught is at present supplied by steam jets, which are admitted through cast iron side boxes, but arrangements are being made to admit the jets immediately under the gratings at the front of the cells. The temperature of the furnaces varies between 1800 deg. Fahrenheit and 2200 deg. Fahrenheit. The boilers were constructed for a pressure of 160 lbs. per square inch, but they are generally worked at a pressure of from 135 lbs. to 145 lbs. per square inch. It was originally estimated that about 40,000 tons of refuse would be dealt with per annum, and, placing its calorific value at one-twentieth that of good steam coal, a saving of 2,000 tons of coal per annum would be effected. The steam is used to work a horizontal compound condensing engine capable of giving 500 indicated horsepower when supplied with steam at 130 lbs. pressure. The engine drives a two-phase generator capable of giving a normal output of 300 kilowatts, each of the two sets of coils being capable of giving 150 kw. at all pressures from 2,800 to 3,000 volts at the terminals of the machines.

Combined Sewage Pumping Station and Refuse Destructors of the Twickenham Urban District. The installation consists of a pumping plant comprising two triple expansion vertical condensing engines with a capacity of 6,000,000 gallons per day, two Lancashire boilers connected to specially constructed furnaces for burning house refuse, one reserve Babcock & Wilcox boiler for use at times when the destructor furnaces are not available, with auxiliary plant for electric lighting, water supply, driving workshop tools and sludge ejectors. The electrical machinery consists of two 10 kw. steam dynamos, the engines being tandem compound taking steam at 125 lbs. Current at 200 volts is taken from the works by means of vulcanized bitumen insulated cables, and is used to light the Council's isolation hospital at Whitton, situated over a mile from the works. The current is transformed at the hospital by means of a rotary transformer to 50 volts, which is the pressure used throughout for lighting and power. The whole of the steam required to work the plant is raised from the burning of the house refuse. A test of the destructor was carried out in February, 1907, when it was found that 1.9 lbs. of water from and at a temperature of 212 deg. F. were evaporated per lb. of refuse consumed.

Combined Power Plant and Refuse Destructors of the Corporation of Bradford. The city of Bradford has four separate destructor installations, comprising twelve Horsfall cells arranged back to back in two groups of six cells each; twelve Horsfall cells arranged in a single row; six Horsfall cells in one row, and eight Manlove and Alliott cells. Steam is generated in three multitubular, one Lancashire and two Babcock & Wilcox boilers. The total power, which is produced entirely from the burning of the city's refuse, amounts to about 1,000 indicated horsepower. The power is utilized at the different installations by four engines, which drive twelve mortar pans and three crushing and screening plants, and by four combined high speed engines and dynamos for electric lighting purposes. It is also used to drive a complete

slab making plant with intensifiers and mechanical concrete mixers, a fish manure plant, and for supplying steam to the disinfecting station, and the power required in the various workshops. All the depots are lighted by electricity and the mess rooms and workshops are heated by steam pipes. It is estimated that the utilization of the steam for heating purposes has alone effected a saving of 60 pounds ($300) per annum.

Combined Electric Power Station and Destructor Installatior of the Corporation of Preston. This installation was constructed in 1903. The destructor plant consists of a four-grate Meldrum Simplex Regenerative furnace, having a total grate area of 100 square feet. The furnace has a front feed and deals with about fifty-five tons of refuse per day. The forced draught is supplied from steam jets. There are four Lancashire boilers, each 30 feet long by 8 feet in diameter, and they are constructed for a working pressure of 200 lbs. per sq. inch. The steam is used to drive the engines generating the electricity for the tramway traction, each of which develops almost 500 indicated horsepower. In all about 20,000 board of trade units are generated per week.

Combined Sludge Pressing and Destructor works of the corporation of Ealing. The corporation of Ealing has one combined station for the purification of the sewage, the disposal of the refuse and the conversion of the residuals into paving slabs. The works are designed to deal with the sewage and refuse of a population of about 40,000 persons. The destructor installation consists of nine Manlove & Alliott cells placed side by side. About fifty tons of refuse are disposed of per day in winter, and 40 tons in summer, in addition to which an average of 70 tons of pressed sludge is burnt per week. Forced draught is supplied to the furnace by means of three fans driven by an independent engine. Steam is generated in two multitubular boilers, which are capable of raising sufficient steam to develop 100 indicated horsepower. The method of treating the sewage is as follows: The solids are chemically precipitated in continuous flow tanks by the addition of a small proportion of liquid lime. The clarified effluent is treated partly on contact beds, and partly in percolating filters. The precipitated sludge is drawn off from the tank through a screen designed to intercept rags, paper, etc. The materials arrested by the screen are removed by hand, and burnt in the destructors. The sludge is passed into a ram, and an air pressure of 80 lbs. to the square inch is applied, which forces it into three pressing machines. The compressed air is provided by two special engines working in connection with an air cylinder. The molds of the presses consist of a number of castings, made in two parts, to fit tightly together. Between each set of molds is placed a piece of coarse canvas. Holes are provided in the base of the castings, so that the liquid forced out of the sludge may drain away. This is pumped back to the sewage works for further treatment. The sludge is left in the presses for about one and a half hours, at the end of which time the cakes are fairly solid. These are then removed in small tip wagons to the hopper platform on to which the town refuse is emptied from the collecting carts. Here they are broken up, mixed with the refuse and delivered together into the furnaces. The whole of the steam required for these operations, and also for a complete slab making plant is derived solely from the burning of the refuse and the sludge cakes.

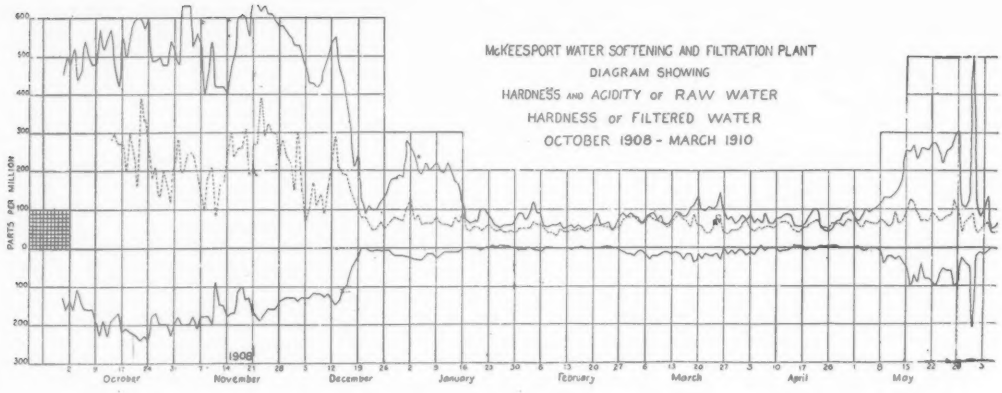
EXPERIENCE WITH AND RESULTS FROM MUNICIPAL WATER SOFTENING.*

By Alexander Potter, Consulting Engineer, New York City.

MUNICIPAL water softening is still in its infancy. Early experiences in municipal water softening in America were not satisfactory, but through no fault of the principles involved.

The theory of water softening is not new. The theory of the softening of waters containing a temporary hardness due to calcium and magnesium carbonates held in solution, by the presence of free carbon dioxide, was enunciated by Dr. Clarke, of England, some fifty years ago. The treatment of such waters consists of the addition of lime-water or milk of lime, applied in carefully regulated quantities. The resultant reaction is the immediate

*A paper before the American Water Works Association.

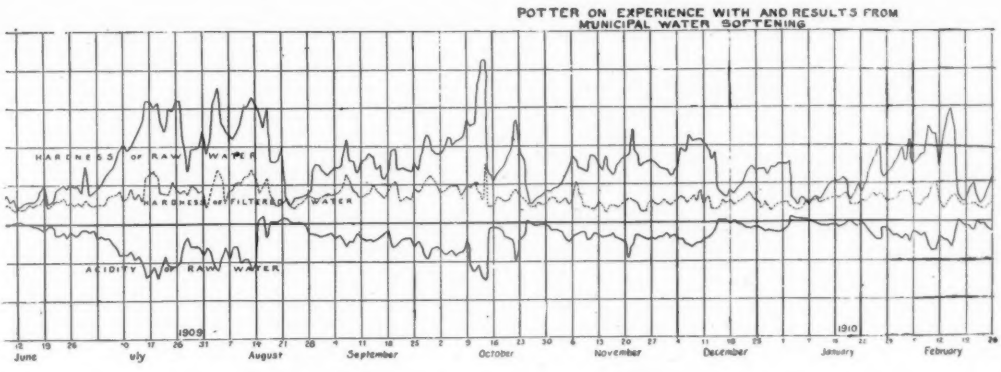


union of the added lime and the free carbon dioxide, causing the precipitation of calcium and magnesium carbonates.

Waters possessing permanent hardness, as well as those which are contaminated by mine or factory refuse imparting to the water metallic salts and free sulphuric acid in solution, cannot be thoroughly treated with lime alone. This hardness can be most economically counteracted by the use of lime and soda carbonate. This principle is familiarly known as the Porter-Clarke method, and although it was suggested over fifty years ago, no other process has been invented to supplant it during all these years. There are a number of different water softening systems on the market at the present time. The principal advantage of one system over another is simply one of economies in the distribution and use of chemicals, and the removal of waste products of the process.

So far in this country water softening has been employed in municipal plants only when, to use the vernacular, the cities employing it have been "up against it." This was notably the case in Winnipeg, Canada; Oberlin, Ohio; McKeesport, Pa., and Columbus, Ohio. Perhaps no city has ever been in greater need of nor has had a harder problem of water softening than the city of McKeesport, and the author was fortunate enough to be retained to advise a plan for its solution. For at least six months of each year, the water of McKeesport was fit neither for man nor beast, nor for any commercial purposes whatsoever, save, perhaps, for street sprinkling. So bad was the water supply at McKeesport that it was characterized in the United States geological reports as the worst water in the country. It was so bad that, notwithstanding confirmatory reports upon the plans proposed from persons qualified to judge as to the probable outcome of the treatment, money for the construction of the plant was appropriated reluctantly by the governing bodies. In fact, each time that the Board of Water Commissioners applied to councils for an appropriation to carry on the work of construction, it was the signal for a tirade of abuse on the part of some members of councils against the throwing away of the people's good money for something that was sure to prove an absolute failure. By emulating the motto, "keeping everlastingly at it brings success," we succeeded in completing the plant in record time under the greatest handicaps. So convinced was the author that the plant would handle the water satisfactorily even in its worst condition, that it was put into commission before its full completion. This was done because the river water was more highly acid at this time than at any previous time, and a test of the plant under such conditions was highly desirable.

An examination of the diagram accompanying this paper will show that the conditions existing during the first three months of the trying-out period, viz.: October, November and December, 1908, have not been duplicated since. During this period, also, the water consumption in the city was so great, due to imperfect plumbing fixtures, which had been eaten out by the action of sulphuric acid contained in the untreated water, and to faucets left open in the vain hope that the quality of the water would thus be improved, that the plant was called upon to treat practically the full quantity which the plant was designed ultimately to treat.



The high acidity in the McKeesport water is due to the large amount of mine water discharged into the tributary creeks of the Youghiogheny river, and to the spent acids from the galvanizing works along the shores of the Youghiogheny. The washings from the coke beds are another contributory cause. Furthermore, the difficulties of treating the Youghiogheny river water have been increased during the last few years by the abstraction from the water-shed of practically the entire flow of the Indian Creek, one of the main feeders of the Youghiogheny, and the transporting of this water for the benefit of the Pennsylvania railroad into an entirely different water-shed. The Indian Creek was one of the most permanent streams in the water-shed, and the water from this stream went a long way toward counteracting the effect of the impurities in the river.

The acidity in the water for a number of years previous to the operating of the plant was as follows:

Year	Av'g Acid'y	Max. Acid'y
	Parts per million	
1901	43.0	125.0
1902	42.1	200.0
1903	34.5	140.0
1904	50.6	170.0
1905	32.1	80.0
1906	28.0	120.0
1907	43.4	133.0
1909 Oct. to Dec.	150.0	240.0
1909	33.0	210.0

The acidity in the water since the plant was put into operation in October, 1908, is represented by the lowest curve on the diagram accompanying this paper. An examination of this diagram will convince the most skeptical of the variable character of the water to be treated. The water has jumped from a hardness of 110 at 4 o'clock in the morning to a hardness of 510 4 or five hours later, and from an acidity of 30 up to an acidity of 210 during the same period. To produce a uniform product from the plant under such conditions requires the greatest care and watchfulness on the part of the employes of the plant. An examination of the curve of hardness of filtered water will indicate that a reasonably uniform product has been obtained.

The McKeesport plant was fully described by the author in a paper read before the Engineers' Society of Pennsylvania, and appears fully illustrated in their journal for April, 1909. The technical weeklies have also described the plant at various times. It is therefore unnecessary to consume the time of the association with a description of the plant. Anyone interested is respectfully referred to the publications mentioned.

Novel features of the plant which might be mentioned and which a year and a half of operation have given a sufficient test, are as follows:

The method of cleaning the settling tanks without emptying them or interfering in any way with the continuous operation of the plant. Carriers are built under the floor of the settling tanks. The carriers in each of the four tanks are divided into four zones. Small circular holes ⅞ inch in diameter, spaced 4 feet apart, connect the bottoms of the tanks with the carriers. The outlet end of each set of carriers is controlled by a valve. In cleaning the basins the valve controlling each zone is kept open until the precipitated solids are removed and the water runs free from sludge. The amount of water used in cleaning the settling tanks and baffling tank is approximately 1,700 gallons per day for each degree of hardness in the water.

Another novel feature in the plant

Week Ending	Character of Water and Amount Used							
	Alkalinity		Hardness		Amt. F. W. Pumped Million Gallons	Wash Water		
	Parts Per Million					No. of Hrs. between Washings of Filters	Amt. Per Day Gals.	% of F. W.
	R.W.	F.W.	R.W.	F.W.				
February 13	0	38	57	43	3.705	202	21,428	0.55
February 20	+ 0.7	42	54	48	3.582	336	12,856	0.36
February 27	+ 1.0	47	65	56	3.516	336	12,856	0.37
March 6	− 12.0	51	80	74	3.484	252	17,143	0.49
March 13	− 17.0	53	75	68	3.464	252	17,143	0.50
March 20	− 21.0	46	99	72	3.402	504	8,571	0.25
March 27	− 19.0	31	107	57	3.917	168	25,714	0.66
April 3	− 10.0	34	76	52	3.607	144	30,000	0.82
April 10	− 2.0	27	72	53	3.600	202	21,428	0.60
April 17	− 1.0	22	72	54	3.645	144	30,000	0.80
April 24	+ 1.0	24	72	60	3.600	202	21,428	0.60
May 1	+ 1.0	22	79	65	3.490	202	21,428	0.60
May 8	− 1.0	19	95	66	3.748	144	30,000	0.80
May 15	− 30.0	34	102	73	3.942	168	25,714	0.65
May 22	− 79.0	41	256	92	3.944	252	17,143	0.40
May 29	− 76 0	32	264	88	4.125	72	55,714	1.40
June 5	− 51.0	31	163	62	4.010	101	40,000	1.00
June 12	0	33	69	47	4.004	101	28,571	0.70
June 19	− 5.0	29	66	51	3.877	112	25,714	0.70
June 26	− 21.0	30	87	55	4.074	101	28,571	0.70
July 3	− 28.0	32	95	48	4.491	92	31,429	0.70
July 10	− 53.0	33	152	68	4.362	92	31,429	0.70
July 17	−101.0	32	260	86	4,614	63	45,714	1.00
July 24	−111.0	34	291	99	3.972	84	34,286	0 90
July 31	− 63.0	34	215	86	4.284	46	62,857	1.50
August 7	− 85.0	37	202	91	4.586	40	71,428	1.60
August 14	− 89 0	39	231	114	4.743	36	80,000	1.70
August 21	+ 4.0	32	119	70	4.478	46	62,857	1.40
August 28	0	31	69	56	4.374	126	25,000	0.60
September 4	− 29.0	31	130	71	4.210	40	72,214	1 70
September 11	− 41.0	25	164	91	3.922	63	45,714	1 20
September 18	− 35.0	25	152	81	4.001	72	40,000	1.00
September 25	− 49.0	26	157	78	3.934	59	48,571	1 20
October 2	− 66.0	26	188	100	3.819	56	51,429	1.30
October 9	− 81.0	23	220	88	3.530	112	25,714	0 70
October 16	−109.0	33	280	83	3.704	92	45,714	1.20
October 23	− 39.0	36	178	68	3.497	336	8,571	0.24
October 30	− 7.0	30	82	52	3.341	168	17,143	0.51
November 6	− 22.0	40	112	59	3.355	202	14,286	0.30
November 13	− 34.0	36	153	57	3.572	168	17,143	0.50
November 20	− 38.0	35	149	42	3.376	144	20,000	0.60
November 27	− 50.0	34	174	45	3.535	202	14,286	0.40
December 4	− 37.0	29	140	51	3.528	168	17,143	0.50
December 11	− 50.0	31	208	61	3.714	252	11,429	0.30
December 18	− 13.0	31	119	48	4.250	101	28,571	0.70
December 25	− 10.0	25	111	59	4.332	252	11,429	0.30
January 1	− 23.0	28	143	43	4.631	144	20,000	0.40
January 7	+ 5.0	20	82	42	4.357	101	30,000	0.70
January 15	− 8.0	28	78	58	4.442	168	17,143	0.40
January 22	− 6.0	34	80	58	3.894	202	14,287	0.40
January 29	− 27.0	28	140	64	3.966	202	14,286	0.40
February 5	− 36.0	32	168	67	3.716	144	20,000	0.50
February 12	− 50.0	32	193	65	4.063	144	20,000	0.50
February 19	− 30.0	29	116	50	4.286	126	25,000	0.60
February 26	− 13.0	26	81	41	4.135	168	20,000	0.50
Average	− 33.0	32.5	130	66	3.928	152	29,238	0 72

RESULTS OF WATER SOFTENING AT

Treatment of Water								Cost of Treatment of Water				
Lime		Soda Ash		Coagulant		Hypochlorite of Lime		Chemicals		Labor		
Per Day Pounds	Million Gallons Pounds	Per Day Pounds	Million Gallons Pounds	Per Day Pounds	Per Million Gallons Pounds	Per Day Pounds	Per Million Gallons Pounds	Per Day	Per Million Gallons	Per Day	Per Million Gallons	Total Cost per Million Gallons
800	212	4,929	509	400	152			$24.00	$6.32	$37.27	$9.83	$16.15
600	166	1,800	500	743	207			24.14	6.72	35.94	10.00	16.72
914	261	2,186	623	1,186	213			31.69	9.02	29.91	8.49	17.51
1,000	286	2,700	773	686	196			34.58	9.92	29.49	8.44	18.36
514	148	3,086	892	400	116			35.69	10.32	30.76	8.82	19.14
3,057	885	4,114	1,190	457	132			55.11	15.90	31.12	9.00	24.90
3,600	918	3,857	984	171	44			53.53	13.65	29.67	7.57	21.22
3,543	980	2,443	676	1,200	333			44.99	12.50	30.94	8.56	21.06
1,714	476	1,800	502	800	222			28.86	8.00	30.49	8.46	16.46
1,371	376	1,671	458	571	157			24.97	6.84	30.51	8.26	15.10
1,886	506	1,029	277	286	77			19.38	5.25	30.94	8.38	13.63
2,314	671	1,157	331	800	229			25.22	7.23	31.44	8.97	16.20
4,000	1,068	2,314	618	629	168			41.82	11.14	31.44	8.40	19.54
3,371	854	4,757	1,208	114	29			60.77	15.47	30.07	7.63	23.10
6,657	1,690	6,668	1,690					92.48	23.62	29 55	7.53	31.05
6,628	1,608	6,086	1,480					86.54	20.98	31.44	7.62	28.60
3,286	3,820	3,343	857	114	28			49.05	12.27	30.69	7.63	19.90
1,657	408	2,318	571	971	238			34.00	8.38	31.44	7.72	16.10
886	227	1,800	464	686	177			23.72	6.10	31.22	8.07	14.17
1,343	331	2,314	569					28.63	6.54	31.44	7 72	14.26
1,657	368	3,857	860					42.80	9.30	31.44	6.98	16.28
2,942	673	5,657	1,300					63.12	14.46	30.85	7.06	21.52
6,429	1,400	10,019	2,170	228	49			119.40	15.84	32.72	6.88	32.90
5,857	1,480	10,286	2,580	57	14			117.19	29.52	31.29	7.88	37.40
3,886	908	6,429	1,498					73.74	17.17	31.01	7.25	24.42
6,257	1,360	9,514	2,072					111.74	24.31	31.01	6.79	31.10
6,114	1,385	10,029	2,120					115.78	24.44	29.98	6.36	30.80
5,857	638	3,600	805	772	172			49.10	11.02	31.01	6.88	17.90
1,886	431	2,314	529	578	132			32.29	7.35	31.01	7.07	14.42
3,600	851	3,871	918					49.65	11.76	31.01	7.34	19.10
4,000	1,020	3,857	985					51.31	13.08	31.01	7.90	20.98
2,400	586	3,343	818					40.05	9.78	31.01	7.58	17.36
3,257	827	4,629	1,178					55.20	14.01	29.49	7.49	21.50
4,857	1,275	5,400	1,420					68.76	17.96	29.98	7.84	25.80
4,287	1,214	6,657	1,890					77.96	22.03	31.01	8.77	30.80
5,514	1,402	10,543	2,650	118	32			118.80	32.11	29.51	7.96	40.10
2,971	851	5,143	1,470					58.62	16.78	31.01	8.82	25.60
1,800	539	2,314	692	172	51			29.84	8.93	31.01	9.27	18.20
1,000	297	3,859	1,130	286	85			40.43	12.04	31.01	9.26	21.30
3,000	840	4,886	1,368			21	6	57.80	16.22	30.19	8.44	24.66
3,000	856	4,886	1,445			20	10	58.14	17.17	31.01	9.19	26.36
3,000	847	5,914	1,668			23	6	67.05	18.98	31.01	8.76	27.74
3,000	850	4,371	1,238			6	2	52.14	14.78	31.01	8.76	23.56
3.000	808	6,171	1,660					66.28	18.40	31.22	8.40	26.80
3,000	706	4,114	966	268	61			51.09	12.54	31.22	7.34	19.88
3.000	693	2,829	653			23	5	39.28	9.08	30.56	7.06	16.14
3,000	646	5,143	1,108	20	4			51.36	11.09	31.22	6.74	17.83
1,571	358	2,314	528	714	161	6	1	31.62	7.21	31.01	7.08	14.29
571	128	2,057	463	257	58	26	6	24.91	5.61	30.68	6.90	12.51
1,286	330	2,314	592	457	117	46	12	33.85	8.69	30.97	7.95	16.64
2,600	656	3,600	910	457	115	10	3	46.22	11.68	31.82	8.03	19.71
3,057	823	5,143	1,382			10	3	59.59	16.04	31.68	8.53	24.57
3,514	753	6,171	1,516			10	3	70.34	17.32	31.82	7.83	25.15
3,029	708	3,857	899			14	5	47.58	11.13	31.82	7.43	18.55
1,457	352	1,543	373			20	5	20.38	4.92	29.25	7.06	11.98
2,930	750	4,100	1,046	292	76	15.0	4.0	$52.95	$13.36	$31.16	$8.05	$21.41

McKEESPORT, PA., FEBRUARY, 1909, TO MAY, 1910.

is the economic use of wash water. The entire machinery is operated by a water motor located on the top floor of the softening building. The waste water from the motor enters the wash water basin for the filters. This water, charged against the plant as power, should not be charged as wash water, thus effecting a substantial saving. The amount of wash water shown in the annexed table is, however, the actual amount of water used in washing the filters, and amounts to 0.72 per cent. of the total amount pumped.

Still another feature in the McKeesport plant is the arrangement for the entry of water into and exit of water from the settling basins. The design of the plant allows the water to enter the settling tanks over a long weir with a relatively short travel through the tank to the long overflow weir, with a gradual reduction in velocity as it approaches the outlet weir. For a given capacity of tank the longer the weirs and the shorter the travel through the tank to the overflow, the less the velocity, and consequently the greater the precipitation. The water as it leaves the settling tanks is perfectly clear and free from turbidity.

The character of the McKeesport water is so unusual that tables of cost of operation are apt to be misleading to other municipalities, because the persons seeking data of cost and practicability of water softening are apt to be swayed adversely in their opinions by applying to their own cases the costs of producing a softened water at other places, as for instance, at McKeesport, without taking into consideration the possible differences in conditions between the water to be dealt with at different places.

The only fair way to analyze the cost of any particular plant is to weigh the cost thereof against the benefits to be derived therefrom. Bearing this in mind, we have on the one hand to consider: (a) first cost of plant; (b) cost of operation. As against this we must also consider (c) the improvement in the water; (d) the decrease in operating expenses of the plant; (e) decrease in wear and tear upon the plant; (f) decrease in plumbing bills paid directly by private citizens; (g) the decrease in the cost of soap; (h) lengthening the wear of linens, flannels and other fabrics, and (i) increase in the length of life of boilers.

Taking the case of McKeesport, the annual interest on the cost of construction is approximately $10,000.

The cost of operation for one year is $30,700.

The total cost of producing 4,000,000 gallons of softened filtered water a day is $40,700 per annum.

Against this we have the following saving:

Since the softening plant has been installed the water department has dispensed with a number of its employes engaged on repairing curb connections, whose wages, according to the president of the Board of Water Commissioners, amounted to $15,000.

The private consumers expended annually in maintaining their plumbing fixtures over $35,000.

Since the softening plant has been installed only 72 per cent. of the water previously required is now pumped, thus making a reduction in the coal consumption of $6,090 per annum.

The reduction in repairs of plant amounts to $3,000 a year.

From the best evidence obtainable, the saving in soap and soap compounds alone amounts to over $10,000 a year, and the saving in the wear and tear in washing of fabrics of all kinds can be set down at $20,000 a year.

Summarizing these, we have, on the one hand an added cost of treating the water of $40,700; and on the other, a saving, as enumerated above, of $89,090.

This balance sheet shows that the introduction of the water softening plant for the city of McKeesport, instead of being an added burden to the people, has proved to be a saving of $48,390 per annum.

As a side light upon the saving effected in the McKeesport plant it may be stated that before the water softening plant was put into commission about 156 plumbers were at work in the city. Out of this number only 46 were left four months after the plant was put into commission, and at the present time about the same average number of plumbers are employed in McKeesport.

In making the above comparison the author has not touched upon the saving in life due to the reduction in typhoid fever, which has been quite marked, for he believes it is not altogether fair to take the difference in the death rate for the year before and the year following the introduction of such an improvement and credit this saving of life wholly to the water treatment plant, because for such a comparatively short period there may

have been many other causes contributing to the reduction of the death rate. It is fair to assume, however, that no one factor was more responsible for the reduction in the typhoid fever death rate than the water treating plant.

Beside all these considerations there stands out prominently the fact that the McKeesport water now has that palatable, crisp, fresh taste which is delightfully refreshing, a quality often lacking in public water supplies. The water is acceptable for drinking, cooking and bathing alike. A greater cleanliness on the part of the people is also observed generally throughout the city.

The author presents herewith a table showing the characteristics of the water from week to week; also the amount of lime and other chemicals used in the treatment of it, together with the cost of treatment.

The plant at McKeesport includes a filtration plant, which is in itself an interesting study, aside from the softening plant.

During the summer of 1909, when the bacterial count in the raw water ran from 5 to 100 or 200, the bacteria in the settled and filtered water showed increases over the number in the raw water. The numerical increase in the bacteria in the filtered water over the raw water completely annihilated removal or efficiency percentages and did not present a very creditable showing. Furthermore, it was impossible to determine the character of the bacteria on any one day until two days later, consequently there was always a possibility, when the raw water contained bacilli coli, of their passing through the filter as well. It is important to note also that so far as the reduction of bacteria is concerned the filters failed to produce any reduction over the settled water. In fact, it is the exception rather than the rule that the bacterial count of the filtered water is lower than the bacterial count in the settled water; all of which goes to show that, in a water similar to that treated at McKeesport, it is possible to dispense with the filter entirely.

Consequently, in October, 1909, the use of hypochlorite of lime was used at the suggestion of the author, and has been in use ever since. The effect of the use of hypochlorite of lime has been to almost completely sterilize the water in the softening plant. The use of a sterilizing agent is a sufficient safety factor for destroying bacteria that would not otherwise be entangled and brought down with the precipitates in the settling basins. The amount of hypochlorite of lime used varied from 2½ to 12 lbs. per million gallons, and averages 4 lbs. per million gallons. In the McKeesport plant the hypochlorite of lime is admitted at the entrance of the baffle mixing tanks about one hour before the soda is admitted to the baffle mixing tanks. The hypochlorite of lime is dissolved in the coagulant tanks, and the coagulant pumps are used for the application of the hypochlorite to the water.

No coagulant has been used since the application of the hypochlorite of lime. A remarkable condition exists with the water at McKeesport, where, with 450,000 bacteria and 1,500 turbidity in the raw water, no coagulant was used, and yet a clear water was secured from the filters.

In the opinion of the author there are very many towns in which the introduction of water softening, coupled with the use of some sterilizing agent, would present the most satisfactory solution of the water purification problem, and be commercially more desirable.

It is to be hoped that this phase of the question will receive greater attention than in the past, for it at once makes commercially available the treatment of waters for other than purely sanitary purposes. There are so many cities throughout the United States and Canada afflicted with hard waters that the purely commercial aspect of water softening must demand attention to a greater degree in the future than it has in the past. The benefits of a soft water are fully as valuable to the private citizen in the uses to which he puts his water supply as they are to the large manufacturing concerns, which, it is well known, are being forced to install private softening plants for the preservation of their boilers, and the percentage of saving to the private citizen by the introduction of softened water will be found to be just as great proportionately as the saving to the manufacturer.

The average cost of chemicals at the McKeesport plant during the last year was as follows:

	Per ton of 2,000 lbs.
Lime	$ 8 30
Soda ash	18 00
Sulphate of iron	11 00
Alum	12 50
Hypochlorite of lime	42 00

The character of the water at McKeesport perhaps requires the application of a greater amount of chemicals per million gallons than any other water in the country, and the satisfactory results obtained should go a long way toward dissipating the somewhat prevalent idea that the use of chemicals in water treatment is injurious to health.

EFFECT OF SEWAGE AND SEWAGE GASES ON CONCRETE.*

By Sydney H. Chambers, Engineer to the Hampton Urban District Council, Hampton, England.

THE subject of the present communication, the author stated, was one in regard to which it might be assumed that the available evidence was either inconclusive or of a more or less negative character. For, notwithstanding that cases were on record of destructive changes in tanks and sewers, the opinion tended to prevail that when the concrete construction was sound no marked disintegration need be anticipated, either from sewage or from its emanations.

The author's experience, however, did not support this view, and it was to the elaboration of this, the positive side of the question, that he desired to direct attention. During the last five or six years he had had very special opportunities for studying the problem.

In order to be in a position to more fully appreciate the disintegratory changes occurring at Hampton, and the deductions drawn from them, the author thought it was necessary to describe, even though briefly, the installation in question, and to state the character of the sewage, as well as to outline the nature of the materials used in the construction of the tank and channels.

THE HAMPTON INSTALLATION.

The nature of the sewerage system was water carriage, primarily flowing by gravitation, and, secondarily, raised by plenum pneumatic power. The sewerage was entirely and completely on the separate system. The installation consisted of a screening chamber, two detritus tanks, a hydraulic tank, and triple-contact beds, and an air-purifying filter.

The sewage on its arrival at the works was delivered from the rising main into the screening chamber, and after passing through the screen, was conveyed by a channel to the detritus tanks. From these tanks the sewage entered the hydrolitic tank, which, together with the detritus tank, was installed in 1903. The disposition of the tank was such that the main bulk of the sewage—80 per cent.— passed through at a comparatively high rate of flow, issuing in four hours as a clarified liquid, while the small volume—20 per cent.—containing the deposited matters, was sixteen hours in the tank. After flowing over the weirs of the first portion the liquid entered a channel which led to the second portion of the tank, consisting of four hydrolysing chambers arranged in sequence, and filled with large flint stones. The liquid having taken three hours in its passage through these four chambers, entered the lower channel, which conducted it to the contact beds.

The screening chamber, the tank, and the channels leading to and from the tank, as also the effluent channel of the primary contact beds, were covered in. The entire installation was ventilated by the hydro-mechanical system of sewer ventilation, and the withdrawn gases were purified by being passed through an air filter.

The sewage of Hampton was of a strong domestic character. It had undergone thorough disintegration by the lifting operations, and by the putrefactive changes occurring in the rising main. It was malodorous on its arrival at the screening chamber, where as it left the rising main, it evolved sulphuretted hydrogen and other bad-smelling compounds. The liberation of these gases constituted a nuisance necessitating the screening chamber, channels, and tank being covered in, and means being provided for drawing a large volume of air through them before discharging the gases into the atmosphere.

THE CONCRETE USED.

The whole of the tank and channels,

*Abstract by *The Surveyor and Municipal and County Engineer* of a paper before the Concrete Institute.

the author said, were constructed of Portland cement concrete. The walls of the tank are 6 ft. 6 in. in thickness at the base, and 1 ft. 6 in. at the top, and are strengthened by tie-rods; the roof was 6 in. in depth and was reinforced by "expanded metal" paving slabs. The work was executed by departmental labor, and the best materials were used.

The concrete was composed of 1 part of Portland cement properly mixed with clean water and 6 parts of ballast thoroughly free from loam, clay, mud or dirt of any kind, and no material was allowed to be used larger than would pass through a 2-in. screen.

The makers of the "indurated" paving flags state that they are composed of Mountsorrel granite chippings, washed and crushed to pass through a ¼-in. mesh sieve, and heavy Portland cement made by themselves, the raw material for which is obtained from the Barrow-on-Soar blue lias beds. The materials are mixed in the proportion of 1 part of cement to 3 parts of granite.

EFFLORESCENCE.

Early in 1905, a few months after the hydrolytic tank had been put into use, it was noticed that the roof and walls of the hydrolysing chambers above the liquid level were white or yellowish in appearance. This efflorescence was not crystalline in structure, but was of a chalky subsistence, and resembled distempered work on a damp wall. On examination it was found to be due to a thin covering of sulphur, which could be easily removed by rubbing. Later the face of the walls and the roof in the second part of the tank showed signs of peeling, and the concrete appeared to be disintegrating. A thorough inspection of the installation was thereupon made.

DISINTEGRATION.

At the screening chamber nothing appreciable was observed, either at the highest water level or on the underside of the roof. The concrete was sound, and when struck had a good ring. Immediately adjoining this chamber was the main sewage inlet channel, along which the whole of the gases pass to the main air duct leading to the air filter. At this point slots were made in the concrete to receive a dam; the concrete at the back of the grooves was found to have disintegrated, although the sides were perfectly sound.

Further along this channel it was observed that the greatest disintegration had taken place on the walls at the liquid level. Owing to variations in the flow of the sewage, the level of the liquid in the tank and channels rose and fell; thus a certain area of the walls was constantly immersed in the sewage, and then exposed to the air. This area was, consequently, even when not immersed, much wetter than the part of the walls which was always above the level of the liquid. The latter area at this point showed crosion, which, however, had not penetrated so deeply as that at the level of the liquid itself. At the liquid level there was a deep groove in the concrete, and above this the face of the work had bulged out and lost its nature.

The first portion of the tank—i. e., the hydrolytic tank proper—appeared to have suffered very little. The walls and roof had only the slight sulphur deposit. At the liquid level, which varied less than in the channel, there was a slight erosion. The second part of the tank—i. e., the hydrolysing chambers—was found to have suffered in places to a marked degree. It was observed on breaking through the erosion on the surface that the concrete at the back was moist, soft and gritty. Also, it was noticed that increased dampness constituted an important factor in the destruction of the concrete, for the lower parts of the vertical faces of the beams supporting the roof were more affected than the upper parts. The lower portions of the vertical walls of the tank also were more eroded than the opper. At the liquid level the concrete had been severely attacked, and a deep groove existed in it.

ANALYSES OF CONCRETE IN HYDROLYTIC TANK.

Two samples of surface concrete were taken above and below the liquid level, and the following was the result of the analysis:

	Below liquid level. Sound.	Above liquid level. Unsound.
Appearance.....	Grey	White
Texture.....	Hard	Soft
Ratio cement to sand ..	1 : 2	3 : 2
Sulphate of lime in c'm't	Trace	66 per cent.

CONSIDERABLE DETERIORATION.

The same pronounced effect was to be seen in connection with the concrete blocks, which were grooved to receive sliding boards and project above the liquid level; these blocks had in many instances crumbled away to such an extent as to be almost shapeless. Recently these chambers

were emptied, and it was found that the concrete below the liquid level was perfectly sound and in a good state of preservation.

The lower channel conveying the liquid from the tank to the contact beds revealed the same characteristics as were observed in the upper channel, but the portion at the liquid level was very much more markedly affected.

ANALYSES OF THE DISINTEGRATED CONCRETE IN THE CHANNELS.

Samples taken of the lining of the sides and covering gave the following analysis:

	Ratio. Cement.	Sand.	Sulphate of lime in cement
1. Concrete at varying liquid level	1	2	70.26 per ct.
2. Underside of slab forming cov'r'g	5	1	74.61 per ct.

The air duct taking the gases from the effluent channel of the primary beds and communicating with the tank outlet channel was found to have a coating similar in appearance to that observed on the underside of the covering to the channels.

ANALYSES OF CONCRETE IN AIR DUCT.

Analyses of this coating were made, with the following results:

	Ratio. Cement.	Sand.	Sulphate of lime in cement
Underside of slab forming cover of air duct	2	1	70.71 per ct.

CONVERSION TO SULPHATE OF LIME.

The point to observe in the above analyses was the conversion of the lime in the cement into sulphate of lime, the sulphur being obtained from the sewage flowing through the tank and channels, as well as from the gases expelled from the sewage, and contained in the air withdrawn from the several parts of the installation.

SUGGESTED EXPLANATION.

Much thought had been given to the explanation of the foregoing observations, and it had been concluded that the effects had arisen from the putridity of the sewage and the oxidation of the putrid products by the air supply. The main erosive effect was at the varying liquid level, and was there dependent upon the amount of sulphuretted hydrogen in solution in the liquid. The gas was comparatively small in amount in the incoming sewage and in the liquid in the hydrolytic tank, and increased as the liquid passed through the hydrolising chambers. The results of this were especially well shown in the two channels; the alternate wet and dry area of the upper channel conveying the sewage from the rising main was less markedly affected, while in the lower channel the corresponding area was severely attacked. So with the two parts of the tank; the first part into which the sewage was delivered, and wherein comparatively little putrefaction took place, had not been affected to anything like the extent that the second part or hydrolising chambers had.

When the level of the liquid fell it left the concrete which it previously covered wetted with a liquid containing sulphuretted hydrogen in solution. This wet surface was then exposed to the action of the air supply, which oxidised the sulphuretted hydrogen with the production of sulphur and sulphuric acids; these decomposed the concrete, the lime being converted finally into sulphate of lime. What the exact nature of the intermediate compounds was could not be stated, as none of them had been isolated, but it was probable that the active agent was sulphurous acid, as it was known that cement was insoluble in sulphuric acid. When the liquid rose again, the decomposed concrete was washed away either wholly or in part, and a fresh surface was exposed to action when the liquid fell again. It was the continuation of this cycle which led to the formation of the grooves at the varying liquid level.

CONCRETE ABOVE THE LIQUID LEVEL.

The erosive effects on the concrete above the liquid level were dependent upon the sulphuretted hydrogen evolved from the liquid and mixed with the air supply. Some of this gas was dissolved by the moisture which was present on the walls and roofs, from evaporation and condensation; it was then oxidised by the air, and decomposed the concrete as described above. In this case the decomposed concrete either remained as a coating on the surface, peeled off, or crumbled away.

EFFECT ON CONCRETE TUBES.

In order to observe the phenomenon on concrete tubes, two 9-in. concrete tubes were selected, which were supplied by the makers of the paving slabs previously referred to, and were composed also of similar materials in the same proportion. One of the tubes was coated with Dr. Angus Smith's composition (coal tar, pitch, linseed oil, and resin). They were placed side by side in the second part of the tank

in such a position that they would be subjected to the rise and fall in the level of the liquid. At low level the tubes were not in contact with the liquid, and at high level the liquid rose to half the diameter.

After the tubes had remained in the tank for eight months they were taken out and examined. The coated tube did not appear to have been affected, other than at the highest liquid level, where a thin line could be observed, and when struck it was found hard and had a good sound. It was noticed that there were two areas on this tube without any coating, due no doubt to its having been placed upon two supports to allow it to dry; these areas were soft on the surface and similar to the uncoated tube. With these exceptions the tube appeared to be in as good a condition as when first placed in the tank. On the other hand, the uncoated tube had a distinct line at the highest liquid level, which was found to be soft, and when tapped with a chisel had a dull sound; the interior of the tube which had been immersed appeared soft and had a dull sound when struck; the portion of the tube above the liquid level was unaffected, and when struck had a clear ring.

The author then referred to other cases of disintegration of concrete by sulphur compounds.

CONCLUSIONS.

The deductions to be drawn from the investigations were that the gases in solution in sewage, and those expelled from it, arising from its decomposition, do act injuriously upon Portland cement concrete, notwithstanding the fact that the concrete is constituted of sound and good materials, when the following conditions prevail:

(1) A high degree of putrescence of the sewage.

(2) A moistened surface, which held or absorbed the putrid gases.

(3) The presence of a free air supply.

Further, that in the absence of one or other of the above enumerated factors little danger from erosion need be feared.

FACTORS THAT SHOULD BE CONSIDERED IN MAKING STREET LIGHTING CONTRACTS.*

By S. M. Rust, Greenville Electric Light and Power Co., Greenville, O.

THERE are 143 private corporations in Ohio engaged in the business of furnishing electricity to the public, and of this number more than three-fourths are dependent upon the street lighting of their respective municipalities for their financial success. In almost every other line of business when the success or failure of the entire concern depended upon the business of one customer the factors which enter into that business would be well known to both parties and a basis arrived at which would be satisfactory to all concerned in the contract. But in making street lighting contracts with municipalities the game so far has been a catch as you can affair with one side at least generally ignorant of what they were doing and suspicious of the other because they were ignorant and because they were of necessity compelled to deal with a monopoly.

I think it will be agreed by all present that if this part of the lighting business was understood by the municipalities as well as by the companies making the contracts, there would be better prices and more satisfactory contracts made.

It is not my intention to state just what the prices for street lighting should be, as prices must vary with different localities and are dependent upon the amount of lighting, cost of fuel, cost of equipment and labor, kind of lights, lengths of contracts, etc., but there are some factors which enter into this branch of the lighting business which each party to the contract should know of and for which they should make due allowance in making such agreement. These factors I group into the folowing heads:

Length of contract, kind and number of lights, changes in position of lamps, outages, schedule burned, time of payment, costs of service and manner of contracting.

The length of time that a street lighting contract should run is a very essential factor to be considered by both parties to the bargain. The stat-

*From a paper before the Ohio Electric Light Association.

utes of Ohio have fixed the maximum at ten years. The question is, should contracts be for any less period. If the company is a progressive one and keeps abreast of the times in adopting new improvements for their street lighting service, it should most assuredly not be less, as every such company can count upon completely changing its street lighting equipment at least once in every ten years, and this calls for an outlay that shorter time contracts will not justify. Every street lighting contract should provide that the company furnishing the lights should have the right to change their system to a newer or better system of equal or better intensity during the life of the contract, subject to the approval of the Council or Board making the contract. Instead of this provision injuring the municipality, it would benefit it by giving it the benefit of the improvements in electrical service which are appearing quite frequently, and it would be an incentive to the company to furnish the city with the best and up-to-date service. The proper method of dealing with outages is probably yet to be found. To compel the company to stand the exact price of the lamp when it is extinguished and should be burning is unfair to the company, because of the equipment cost and fixed expenses which always exist, while to excuse the company for continued outage would likewise be unfair to the municipality. A good plan is to agree in the contract just what the outage should be per hour per lamp, and it is suggested that the amount be two-thirds of the price received for the lighting of the lamp.

The kind of lamps to be used in lighting a town or city must depend somewhat upon the size of the municipality. Companies should be careful not to overlight a city in the beginning, as all municipalities grow rapidly and there is a constant increase in the number of light wanted, the lighting bill may become too great in comparison to other city expenditures and produce dissatisfaction. While most municipalities do not make any mistake in this regard and are generally under lighted, there are some that have more lights than the city can well afford to pay for. This is like overselling a man in goods. He may pay for the goods, but always results in a dissatisfied customer. So far there has been nothing invented for street lighting superior to the arc lamp. Its reliability, invention of its rays and ease of arranging its circuits had made it a favorite in any contract for street lights. In view of the recent inventions of the series tungstens, a price should always be agreed to for the installation of smaller units in out of the way places in order that the city may light dark spots at a less cost than the arc lamp, which is too large for the purpose. Series tungstens are now made to fit the amperage of almost every size arc lamp and can be installed on the same circuit and operated simultaneously with the arc lamps. Reports from this class of lighting are all favorable as to its satisfactory operation and length of life. In the smaller municipalities it is a question whether the series tungsten will not in time supplant arc lighting entirely. Its economy of consumption and consequently lower price will enable the introduction of a largely increased number and avoid the shadows of foliage, which is always dense in the smaller towns.

The number of lights that a municipality can use will determine in some measure the price that should be paid. At the end of this paper will be found an estimate of the cost of operating a 100 lamp street lighting outfit and it may be safely said that if the number is decreased the cost is increased and further that the price for a street lamp should not be fixed without taking into consideration the fact that the fixed expenses of the plant, sometimes called overhead expenses, will be the same whether 50 or 100 are contracted for.

The schedule that lamps are to be burned must also depend upon the size of the municipality. The writer is inclined to think that it is a mistake to furnish all night and every night service in towns of less than 5,000 inhabitants. For such towns a moonlight schedule is preferable, but every contract should provide that in case the nights are cloudy or stormy, that the lights should be burned during such conditions. Where the town is above 5,000 and under 10,000 inhabitants, it is a very good plan to have the contract provide for four lights off in each month, unless they are stormy or cloudy. By doing this the plant is enabled to make repairs to its arc lighting equipment, without sustaining outages, and plants in cities of this size can not afford to have so large an equipment as will guarantee continuous service. Cities that are above 10,000 will usually require all night and every night service, and cities of this class will usually justify a sufficiently extensive electrical

equipment, that will enable the company to give every day service on its street light service without inconvenience.

The time at which bills should be paid should always be stated in the contract. It is preferable to make it monthly. To allow bills to grow too large causes the public to murmur at their size, and in addition it is just as easy for the city to appropriate in its semi-annual appropriation as it is to allow bills to run on and be paid quarterly or semi-annually, besides it is a great convenience to the company to have the use of the money, as the sum usually received for street lighting is sufficient to take care of the operating costs in a considerable measure.

The manner of contracting in Ohio has been the subject of considerable controversy, but it seems to be the practice to make such contracts without competitive bidding, as a very large proportion of the contracts of Ohio have been made without such bidding. Section 2491 of the Revised Statutes, provides, that the muncipal corporation may contract with such company for supplying with electric light, natural or artificial gas, for the purpose of lighting the streets, squares and other public places and buildings, in the corporate limits. And Section 1536—205, and being Section 45 of the Municipal Code, provides, "that the council of any city may authorize and the council of any village may make (subject to the provisions of Section 2491 and 3551 of the Revised Statutes of Ohio), a contract with any person, firm or company for lighting the streets, lanes, lands, alleys, squares and public places in the municipal corporation, for a period not exceeding ten years, and the requirement of a certificate that the necessary money is in the treasury shall not apply to such contract."

Interpreting this latter section according to its language, it would be impossible for the council to authorize the board of public service, in a city, to make a contract until such person had been ascertained, and it was evidently the intention that the council should authorize a contract with a company and in cities the board of public service would have to carry out the contract, as authorized by the council. In over three-fourths of the cities of Ohio, this course has been followed and should be the proper course followed. There should be an amendment to the statutes of Ohio, clearly defining the manner of making the contract, and such contract should not be let by competitive bidding.

The costs which enter into street lighting should receive very careful consideration from the company. I am of the opinion that many street lighting contracts are made below actual cost. The following figures are based upon the average cost of a small plant of 100-arc light capacity, taking into consideration cost of construction, maintenance and operation and using the standard enclosed arc system:

I estimate that each lamp will consume 600 watts per hour, and the time of burning 4,000 hours per year, this will make a total consumption of 2,400 kilowatt hours, or 3,217 horsepower hours per lamp per year. Estimating that the average small plant will require 6 lbs. of coal per horsepower, the coal consumption for each lamp would be 9.65 tons, which figured at $2.50 per ton in front of the boilers, would be $24.12. The lamp will have to be trimmed about 50 times, and I estimate the cost of trimming at $1.00. It will consume 50 pairs of carbons, which figure at $2.30. The repairing, time and material would amount to $5.00, cost of installing about $120.00 per lamp, and figuring 10 per cent. depreciation, would amount to $12.00 per year. Cost of labor and salaries would aggregate $12.00 additional and the interest upon the investment $7.20, or a total cost of $63.62 per year. That these figures are certainly low, I would refer to the report of the commission appointed for St. Louis, to investigate the advisability of that city providing its own street lighting system, in which they found that the cost of operating an arc lamp for a city the size of St. Louis, would be approximately near $70.00 per annum.

The writer is inclined to think that the time has arrived to educate the people on the costs of producing electricty, and instead of dealing with a municipality as if you were handling something that was myterious, the factors which enter into such contract should be known and understood by all parties thereto. When it comes, the prices for street lighting will be more equitable and will not be lower than they are now.

BRICK PAVED HIGHWAYS.*

By W. P. Blair, Indianapolis, Ind.

THAT the interest of a manufacturer of a machine or appliance should follow it into the hands of the consumer, that he should instruct and advise as to the manner and method of its use in order to obtain the best possible service, has for years been accepted as perfectly proper. It is conceded that a sensible manufacturer designs his product for public appreciation, and the effort is to produce something that will wear indefinitely or serve its object most perfectly and depend upon increasing popularity in an ever-extending market to absorb the product. The manufacturer who pursues any other course either fails to realize the market 80,000,000 consumers offer, or is attempting commercial suicide.

New and untried articles are generally put out by demonstrators and in recent years several of our largest and most successful manufacturing industries have been built upon the exploits of these so-called experts. The reaper grew into its present state of perfection not in the factory, but out in the wheat field, where representatives of different machines vied with each other to make the record cut under test conditions. Weakness thus exposed was immediately corrected, and in this line we no doubt have the survival of the fittest.

That an article of such common, everyday knowledge as a brick needed any such expert demonstration was doubted by the manufacturer himself, and practically hooted at by the public, but as the public grows wiser it realizes how little it really does know.

Probably one of the first branches of the clay industry which found it necessary to employ experts was the drain tile man, who found himself flooded with complaints that water would not run through his tile, and who generally found that an attempt had been made to run it up hill instead of down, that there had been an attempt to put 8 inches of water through a 6-inch tile, or that the whole trouble arose from an idea that the tile ought to take water through its pores instead of at the joints, and with this in view, a tile so soft had been employed that it was soon dissolved and the flow stopped.

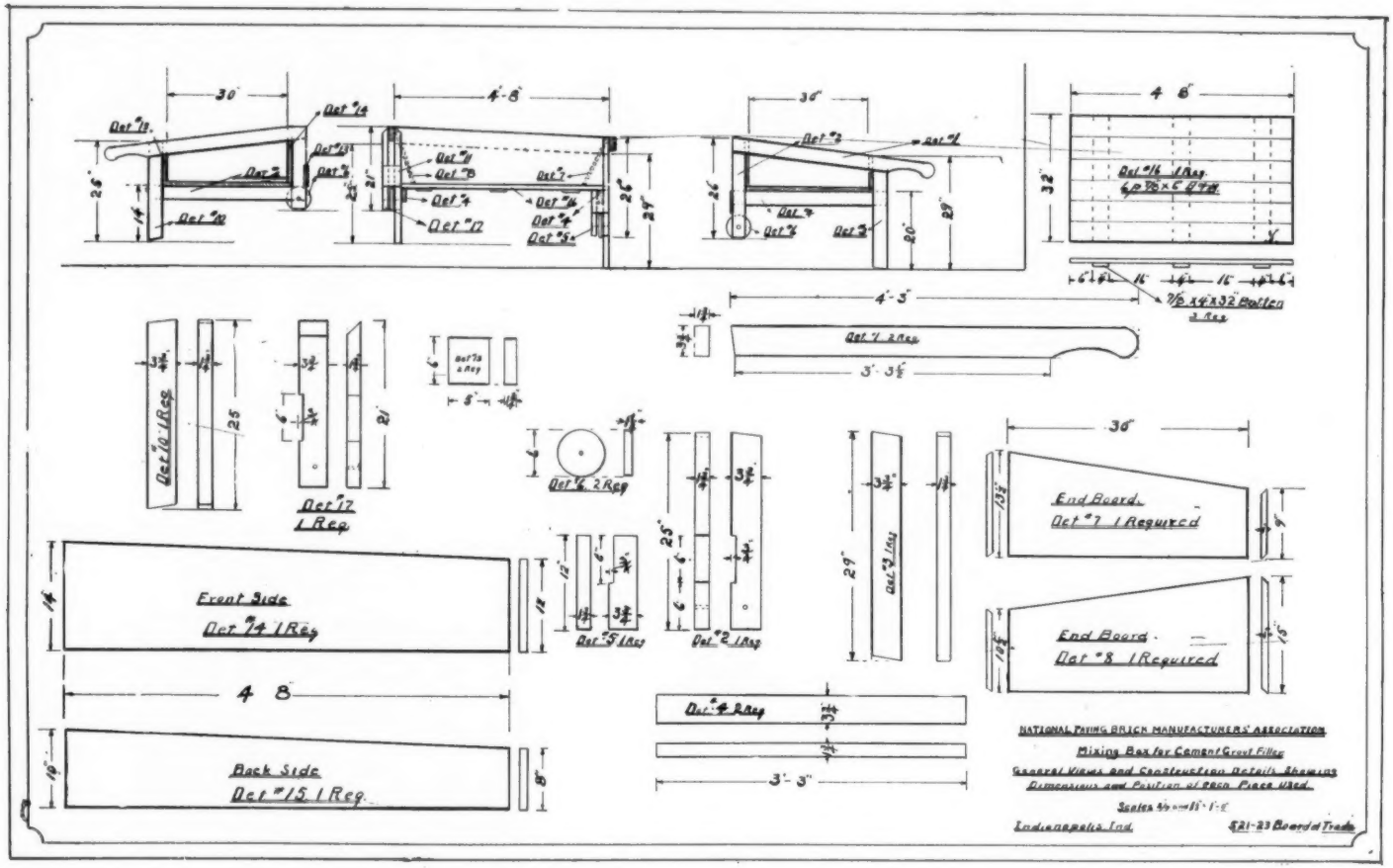
There is perhaps no part of municipal work which has been subject to more experiment than street pavements. There is no part of the work, on the other hand, that is simpler of solution in a way to be satisfactory to the user, economical to the taxpayer, and a credit to an administration. The solution is a brick pavement carefully, properly constructed, in the manner which the manufacturers recommend and which they are endeavoring to impress upon the servants of the public, and which to obtain they are bringing as much influence to bear as is possible to exert through the channels of legitimate advertising and publication for free distribution of text books upon the subject.

The effect of this campaign is to at least occasionally secure a piece of pavement which is an object lesson to the neighboring towns and a stimulus to the business in that community, for, once the merits of a thoroughly good brick pavement become known, the property owners, who pay the bills, insist that no other material be used. In spite of these proven conditions, however, we find an occasional manufacturer who is so indifferent to his own interests that he allows, without expostulation, his material to be used to its greatest disadvantage and refuses to bear his proportion of the expense necessary to an education of the public. Gradually competition closes in around him and his plant is offered for sale, the confidence in his material destroyed at home and its reputation gone in outside markets—simply a result of a short-sighted policy, avoiding responsibility after his product has passed his kiln doors or he has received his money.

The effect of the attitude of the manufacturer of paving brick upon the public is far more serious and far-reaching. Truthful, reliable information upon the subject of paving material in general, and the manner of constructing brick streets in particular, means the saving of thousands of dollars annually to the taxpayer in repairs and maintenance, as well as first cost, and means comfort and satisfaction to all who use the public highways, to say nothing of the cheapened cost of transportation.

Engineering problems have been many and varied during the last past decade. In the designing and building of bridges and edifices of many kinds,

*A paper before the National Brick Manufacturers' Association.


Det "16 1 Req.
6 @ 7/8 x 6 @ 7/8
7/8 x 4" x 32 Bolts
2 Req.
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End Board.
Det "7 1 Required
End Board.
Det "8 1 Required
Front Side
Det "14 1 Req.
Back Side
Det "15 1 Req.
4 8
3'-3"
NATIONAL PAVING BRICK MANUFACTURERS' ASSOCIATION
Mixing Box for Cement Grout Filler
General Views and Construction Details Showing
Dimensions and Position of Each Piece Used.
Scales ½" = 1'-0"
Indianapolis, Ind.
521-23 Board of Trade

in the building and equipping of steam and electric lines, water works and electric lighting, the skill and ingenuity of the engineers has kept pace with the progress of civilizing advancements. It is a fact, however, inexplicable as it may be, that the designing and construction of vitrified brick roadways, as they have been built for the most part in the last ten years has been a wanton waste of money; viewed from an engineering standpoint, a disgrace to some one and an awful burden upon the taxpayers.

At whose door this responsibility shall be laid, I will not undertake to determine. Interested as I am in the brick business, if I could revolutionize this condition of things I would gladly do so. I believe the engineers of the country can, if they will, so change the practice in building vitrified brick roads that those that are to be built in the future shall be similar in quality to those that are found in such cities as Cleveland and Sandusky, Ohio, and Grand Rapids, Mich. Regardless of the influences that have induced and persuaded brick street building as now obtains, is it not possible to reach such a certain conclusion by reasoning together as will properly direct and cause us to build brick streets at their best?

I have been actually present on few jobs where the sub-grade has been properly and carefully prepared so that it conformed to the grade of the finished street. The sub-grade is often devoid of any proper compression. In most instances, no two consecutive square yards are alike; one square yard may be to grade, but the next one may be I inch below grade, but exactly to grade is a condition not found. (Not infrequently the specifications require the use of a roller so heavy that it is quite impossible to compress the sub-grade at all.)

In the very next step it necessarily follows that a uniform thickness of foundation is impossible. However, the first defect mentioned might be cured to a very considerable extent (by increasing the concrete in depth wherever necessary), but here we are met by the contractor's selfish interest, and it is next to impossible to compel him to put in more than the required depth of concrete foundation that the surface of it may be uniform with the grade of the finished street, and that it be made smooth, for it is absolutely essential in the construction of a brick street that the surface of the concrete foundation be made smooth. Now, what I mean by smooth is, not that it shall be perfectly smooth; rather, that it shall be so nearly smooth that no depression shall be found or elevation permitted exceeding a quarter of an inch above or below the proper grade.

I know that for the engineer to require this condition of surface is often met with a very serious objection. I have had many contractors insist that it is not possible to procure either broken stone or gravel in size or in any proportion of mixture making possible this requirement, and engineers requiring it have been denominated cranks, to my knowledge. Yet concrete foundations have been put in exact accordance with the contract specifying that this shall be done. Without such a prerequisite there is no possibility of using a 2-inch sand cushion upon which the brick are to be laid.

But why a 2-inch sand cushion? And why not a 1-inch sand cushion, as is known to have been called for by the government in one of its navy yard specifications, and under which proposals are to be received within a few days. Why not 1 inch? Simply for the reason that 1 inch will not afford sufficient relief from the vibration formed by the impact of hoof or vehicle upon the street. The suggestion may be made that the brick should be hard and tough enough to withstand the action of the vibration, but not so. Take away all relief and what is the result? With a small tack hammer you may chip and in a very short time the entire brick may be broken away, if it be placed upon an entirely rigid surface.

Why 2 inches? Without undertaking to give you the physical reason, I will simply say that a 2-inch sand cushion does afford the necessary relief to protect the brick against chipping and destruction from the vibration to which it is necessarily subjected.

Why not more than 2 inches? For the very reason that it is impossible to compress exceeding 2 inches to a condition that will afford any support to the load to which it will be subjected incident to ordinary travel.

So the brick must have this necessary relief; they must have the necessary support, in order that the surface of the pavement under constant use, will remain free from depressions; in order, also, that the cement filler with which the interstices are filled be not necessarily subjected to a strain that might shatter, crush or tend to crush such joints. A brick street, to be en-

USING MIXING BOX FOR CEMENT FILLER ON INDIANAPOLIS SPEEDWAY.

tirely satisfactory, must be entirely free from depressions, every part conforming to the grade. This condition must obtain at its construction and remain so during its use, so that the traction resistance shall be at a minimum and the wavy condition avoided. This result must be anticipated in the preparation of the sand cushion, first spread at the estimated depth of 2 inches and these depressions avoided by the use of a hand roller, weighing, say, from three to four hundred pounds; additional sand applied, rolled and screened again, I should say, at least three times. At the last screening it will be found that the uncompressed sand will not be over ¼-inch in depth at any one point. With such a condition it can be readily perceived that when the brick shall have been placed upon such a cushion, no greater compression will follow the use of the roller upon the brick than is necessary to take care of the uneven height of the brick themselves.

It is certain also that in ironing out what few depressions remain and compacting the brick into the cushion, but very little sand will be pushed into the interstices by the final rolling. By this suggested method the grade of the finfished street may be conformed to most perfectly. It is often the case that specifications should contain express directions as to manner and method of work; otherwise, it would not be possible to reach results desired. This is particularly so in brick street construction.

The brick should be dropped in straight lines upon the sand cushion, with the best edge of the brick uppermost. Economy for the contractor would require that the brick be brought to and deposited within reach of the person who actually lays the brick in a way that will accommodate his method of dropping them in place, insuring the best edge uppermost. Yet many contractors will insist that dropping them in any way, wrong edge or right edge up, in the street and then paying for the service of a man to turn them over with tongs is an economical method. But, previous to dropping the brick in the street, attention must be given to the necessary provision for expansion cushion next to the curb. It too frequently happens the arrangements for this are improvised without thought as to results.

The board should be prepared by beveling a joint eight (8) inches in width, the thickness determined largely by the width of the street. Even in a narrow street the expansion cushion should not be less than 1 inch; 1¼-inch for a 30-foot street, and 1½-inch for a width exceeding 30 feet. This board should be placed next to the curb, worked slightly into the sand cushion before the brick are laid, and remain until the street is finished in all other respects, after which it should be removed within twenty-four (24) hours following the application of the cement filler. The board beveled and being eight (8) inches in width, it is very easily and rapidly removed, leaving a perfect groove in which to pour the cushion material.

After the brick are dropped into the street the surface should be swept, precaution theretofore exercised that no brick go into the street which are dirty, or, after in, that they are not made so by use, as it is impossible for the cement filler to adhere to a dirty surface. After the sweeping, thorough rolling must take place by the use of a roller not weighing over five (5) tons.

As to the filler, the most difficult problem is to convince the public of the utter worthlessness of all other fillers in comparison with the cement filler, and to bring about a full appreciation of the necessity of the proper application of the cement filler. A cement filler that is mostly cement is too brittle, and one that is less than in proportion of one to one is too weak and soft. The specifications must therefore call for a proportion of one to one, and the necessary skill must be employed to put in place in such proportion; if otherwise, the so-called cement filler is unsatisfactory. Compliance with the simple rules we employ will secure the result, exacting, but easy and economical to follow. Why not follow them rather than the hundreds of different methods that invariably bring a failure?

The filler shall be composed of one part each of clean, sharp sand and Portland cement. The sand should be dry. The mixture, not exceeding one-third bushel of the sand, together with a like amount of cement, shall be placed in the box and mixed dry, until the mass assumes an even and unbroken shade. Then water shall be added, forming a liquid mixture of the consistency of thin cream.

The sides and edges of the brick should be thoroughly wet before the filler is applied, by being gently sprinkled. From the time the water is applied until the last drop is removed and floated into the joints of the brick pavement, the mixture must be kept in constant motion.

The mixture shall be removed from the box to the street surface with a scoop shovel, all the while being stirred in the box as the same is being thus emptied. The box for this purpose shall be 4 feet 8 inches long, 30 inches wide and 14 inches deep, resting on legs of different lengths, so that the mixtures will readily flow to the lower corner of the box, the bottom of which should be 6 inches above the pavement. This mixture, from the moment it touches the brick, shall be thoroughly swept into the joints.

Two such boxes shall be provided in case the street is 20 feet or less in width; exceeding 20 feet in width, three boxes should be used. (See specifications for making same.)

The work of filling should thus be carried forward in line until an advance of 15 to 20 yards has been made, when the same force and appliance shall be turned back and cover the same space in like manner, except to make the proportions two-thirds Portland cement and one-third sand.

To avoid the possibility of thickening at any point, there should be a man with a sprinkling can, the head perforated with small holes, sprinkling gently the surface ahead of the sweepers.

Within one-half to three-quarters of an hour after this last coat is applied and the grout between the joints has fully subsided and the initial set is taking place, the whole surface must be slightly sprinkled and all surplus mixture left on the tops of the brick swept into the joints, bringing them up flush and full.

After the joints are thus filled flush with the top of the brick and sufficient time for hardening has elapsed, so that the coating of sand will not absorb any moisture from the cement mixture, ½-inch of sand shall be spread over the whole surface, and in case the work is subjected to a hot summer sun, an occasional sprinkling, sufficient to dampen the sand, should be followed for two or three days.

It is impossible in a paper of this kind to enter into and discuss all the details of construction essential in building of a vitrified brick street at its best. But is not their importance of sufficient interest to command serious attention? In 1909, 8,000,000 square yards of brick pavements were laid in Indiana.

The difference in cost between a good brick street and a bad brick street is so little that it should not be considered. It is true that a matter of one, two or three thousand dollars in the cost of a whole street seems like a saving if a street could be built for less, but considered in connection with the cost of the whole street, which often ranges from forty to one hundred thousand dollars, the advantage to be gained by saving one, two or three thousand dollars is infinitesimal.

As to the difference in actual cost—take, for instance, the foundation, the point wherein a brick street fails more often than in any other respect is that it is put in with a rough and uneven surface, instead of a smooth surface conforming to the grade of the finished street. Now, the increased cost necessary for the contractor to have the foundation smooth can not possibly exceed the cost of one of the roughest character 1 cent a square yard. If, however, this foundation is left in a roughened condition, in all likelihood the real value of the street, both as to its durability and possibilities of its use, decreases fully 50 per cent.

Again, supposing the foundation is made right and a sand cushion of 1 or 1½ inches in thickness, or a sand cushion utilized on which the compression is very uneven, so that it can not be maintained at a uniform 2 inches, in such cases the difference in cost of a sand cushion put in lacking in either quantity or condition can not possibly be accomplished at a saving of more than 1 or 2 cents a square yard less than one exactly and uniformly 2 inches, thoroughly compressed. Yet the want of the uniform 2-inch properly compressed sand cushion insures a percentage loss in the value of the street of more than 50 per cent.

Again, a step upon which depend the highest possibilities of the brick street—the proper rolling of the brick after they are in the street, and the ironing out of any slight depressions found to exist can not possibly differentiate in favor of insufficient and improper rolling exceeding even 1 cent a square yard.

Again, as to the proper application and use of the cement filler, there is no excess of cost either in the use of cement as a filler or its proper application over and above that of an improper application, or the use of some soft, absolutely worthless filler that is often utilized for this purpose at a cost greatly in excess of the cement filler properly applied, the value and satisfaction of which meets every demand.

To sum up, therefore, in actual

money expenditure, the difference in the construction between the good brick street and the bad brick street can not possibly exceed 10 cents a yard, to say nothing of the great advantage to be obtained in the good brick street in meeting every possible requirement of an exacting public in its use, as well as securing the utmost economy by reason of the great durability.

All this is not said by way of complaint. The ability of the engineer is not doubted, but human nature is alike in all professions and in all callings. Indifference toward many things comes alike to all of us—likewise our interest. So our attitude in this whole matter is one of petition. Our attitude is not much different from the little boy who closed his eyes and prayed for a white rabbit, but, on opening them, beheld no white rabbit. He closed his eyes a second time and prayed, with the same result. The third time he prayed vehemently, not even closing his eyes, saying, "Lord, we want that white rabbit, and we want it now!"

THE ELECTRICALLY DRIVEN WATER WORKS PLANT AT MATTOON, ILL.*

By H. W. Clark, Superintendent.

THE water supply of Mattoon is from a sand and gravel stratum, 10 feet in thickness lying 65 feet below the surface, 50 feet of the overlying material being impervious hard pan. The water works were built in 1885, engine house and machinery was located about one-half mile from the principal source of supply, necessitating the building of an auxiliary pumping station where steam was generated for operating a submerged horizontal duplex pump, coupled onto a gang well system of ten tubular wheels. As the water consumption increased other tubular wells were made and such were pumped with direct acting vertical steam heads, the steam for same being piped from the boiler at plant, a distance of 300 feet, and finally as other extensions were made, carried a distance of 900 feet to supply these newly acquired wells. To further keep pace with the steadily increasing demands for water, after carrying steam by pipe line to the practical limit in distance, isolated, independent pumping stations were installed, three in number, each operating steam pumping heads.

It can be readily seen that this plan of operation was quite expensive, bringing up the cost per thousand gallons of water pumped, quite high.

After consideration of the various contemplated modes of operation from a central station; comparing the costs of power from compressed air with that from electricity, and carefully considering the costs of installation, and comparative losses in transmission, the writer favored electrical installation and started an investigation, in the fall and winter of 1904, of the successes of other electrical pumping stations, hoping to profit by the experience of other water works managements. I was greatly surprised at the very few plants found using electricity for pumping water, and was obliged to install this plant almost wholly along new lines.

Our wells which we wished to electrically equip consisted of nine in number (scattered over a territory of a radius of one-half mile, the center of power being about one-third mile from the central station.)

These wells are of tubular construction, 10 inches in diameter, 65 feet deep, each fitted with a Cook strainer 10 feet in length, surrounded by sand and gravel stratum. A six-inch drop line extending down inside of the 10-inch casing to bottom of strainer, contains brass working barrel of pump. On top of 10-inch casing and securely fastened thereto is the pumping head, the top of 10-inch casing being hermetically sealed, entirely independent from the drop suction line, there being properly fitted thereto vacuum gauge and pressure gauge with valves for operation to clean out strainer by back pressure of water, steam or air.

Owing to existing conditions at our plant, it was desirable to pump our

*A paper before the Missouri Electric, Gas, Street Railway and Water Works Association.

supply first from the wells into a large enclosed receiving reservoir then in use at our main pumping station and from there into our stand-pipe and distributing system, thus pumping the water twice, provided such could be done without additional expense over single pumping.

In the installation of this plant we did not lose sight of the factor of reliability and dependable service at all times, the importance of which is well known to every water works manager furnishing water to a community for fire protection.

Our requirement in a power plant for our regular service was about 75 h. p., with necessary reserve for emergency and fire purposes.

Our old boilers (two 65 h. p.) with a working pressure of 80 lbs. were thrown out and replaced by two high-pressure boilers of 125 h. p. each for a working pressure of 150 lbs. Our two old horizontal domestic service and fire pumps of a capacity of 1,000,-00. gallons each were retained for reserve fire service.

Our new machinery installation consists of two high-speed tandem compound engines, each directly connected onto Western Electric generators. These units are rights and lefts and set side by side, and so arranged that the shafts of units may be coupled together in a continuous line and either engine may run either generator. The belt wheel on each engine adjoins and is a part of the shaft coupling, and a single belt is run off of either of these wheels and over a double width pully of a Holyoke Dean double acting triplex pump of 1,000,-000 gallons capacity. The engine and generator units are of different sizes, one larger than the other; the smaller unit being for our present consumption, and the larger for reserve purposes, with a view of reversing plan of operation when the increased load becomes too great for the smaller unit, thus being able at all times to run our operating plant well up to its rated capacity, securing the greatest economy thereby.

Our smaller power unit comprises engine of size 8 inches by 13 inches, tandem compound, rated at 90 h. p.; the direct connected generator, 50 k. w. The larger unit is engine of size 9 inches by 16 inches by 12 inches, tandem compound, rated at 110 h. p., and direct connected generator, 75 k. w. The engine speed is 290 r. p. m., working steam pressure 140 lbs. The current is 550 volt d. c.

These units generate current for operating our motor driven pumps, pumping from wells into storage reservoir heads (9 in number delivering water) and they also operate the triplex power pump which takes the water from storage reservoir and delivers it into standpipe and distributing system. This pump is designed to handle approximately the same quantity of water that is being delivered by the motor driven pumps, and while our entire supply is pumped twice, our operating cost is less than if all the water was pumped directly from the wells into the distributing system, as there is less loss in transmission of current, only about one-half the current being distributed as where single pumping is done. Other savings are made, as in the reduced wear and tear of machinery owing to reduced load. Also, with this system there is secured the advantage of viewing the flow of water as it is discharged from wells into storage reservoir, this being a partial check on the efficiency of the motor driven pumps.

These units also furnish light, both arc and incandescent for the entire plant.

Our well equipments consist of 8 low service installations (the pumps delivering water into the storage reservoir above described under a low head) and one high service installation, this pump delivering water into the mains under domestic and fire pressure. Five of our low service plants are equipped with Downie single acting pumping heads fitted with special balancing or equalizing attachments, driven by 7 h. p. Western Electric motors, directly connected with rawhide pinions. The other three low service plants are equipped with Luitweiler double action pumping heads driven by 7 h. p. motor directly connected with rawhide pinions.

Our high service plant is equipped with a Luitweiler double acting pumping head driven by Western Electric motor, 10 h. p. This plant operates regularly under a discharge head of approximately 50 lbs. pressure, and in time of emergency under a fire pressure of 80 lbs.

The electrically operated wells are each covered by a brick and concrete house, and each house is connected by private telephone to the central station, so that motor attendant may be in communication at all times with the power plant.

The switchboard at the central station is equipped with the usual electrical instruments, comprising volt meter, ammeters, circuit breakers,

switches, etc. From the ammeter indicator, the engineer can instantly detect the stoppage of any motor. As a pilot for the guidance of motor attendant there is placed on top of each pump house a finial attached to a rod, extending through roof of house and connecting onto the pumping head. This finial is in constant motion when pump is running.

As a night pilot, a light burns in front of each house during operation of pump. The stopping of machinery extinguishes light. The throwing of a double pole, double throw switch, cuts in the light without starting machine.

These arrangements enable the motor attendant to readily locate any stopped machine, without making a trip to all.

This plant has been in operation since the fall of 1905. In efficiency it has far exceeded the writer's calculations and expectations.

The operating labor has been reduced from 13 men to 3 men, and the coal consumption has been cut more than one-half.

The plant has proven to be perfectly reliable and absolutely dependable at all times (very much more so than the old plant.) There has never been one moment of time since the building of this electrical plant that same was crippled in any way so as to interfere with the furnishing of a plenty of good water for domestic and fire purposes.

THE CHARTER OF INDIANAPOLIS.*

By Caleb S. Denny, Ex-Mayor.

TWENTY years ago, when I was mayor for the first time, Indianapolis had a patchwork charter, or rather a mere collection of laws, very different from the present charter. There was a common council and a board of aldermen, and committees from these practically controlled the city. The mayor had a little executive power and was also judge of the police court. But committees of the council appointed the police, fire and street officials, city attorney, etc.

That condition so unfavorably impressed our business people that they made up their minds to change it. In 1891 a new charter was adopted, which in 1905 was superseded by a general charter law for the State. Under it the so-called "federal system" of Indianapolis was adopted and applied to all cities of the first to the fifth class. Indianapolis is and will long remain the only city of the first class, and her charter comes nearer to embodying the federal plan than any other city in the country; and Indiana is the foremost state in giving this plan to all cities and towns in the state. In my opinion this plan is the only proper one, concentrating as it does great power and responsibility in the mayor, and keeping the executive, legislative and judicial branches independent of each other.

Under this system the most important branch of the city government is the executive. The mayor is in almost absolute control, and on him is thrown almost all the responsibility. Aside from the council, there are only three officers elected by the people: the mayor, the clerk and the police judge, all for four years. The mayor appoints all other important officers, including four boards, and does not have to submit his appointments to the councils. He appoints the three members of the Board of Public Works (only two being of the same political party), the two members of the Board of Public Safety, Board of Health (two), Park Commission (four); he also appoints the Controller, Corporation Counsel (City Attorney), and the City Engineer. His boards appoint (usually with his knowledge and consent) their own subordinates.

The judicial department is entirely independent of the mayor.

So also is the legislative department, though not so distinctly, for there are some connections between the council, mayor, and, for instance, the Board of Public Works, which have concurrent power in granting franchises to and entering into contracts with public utilities corporations.

Also the council may act concurrently with a board, as where the Board of Public Works begins improvements against which affected property owners file a protest, the council by a two-thirds vote may intervene, override the protest and

*From an address before the Los Angeles City Club.

cause the improvement to proceed.

In general, however, the executive, legislative and judicial branches are independent.

The council has as its chief function the levy of taxes and appropriation of funds. Last winter a radical change was made in the council. Previously it had twenty-one members—one from each ward and six at large. Since the change it has but nine members.

The process of nomination is peculiar and includes the nomination by each political party at the primaries (which are party primaries, pure and simple) of a candidate for councilman for each of the city's six "districts." But all the voters throughout the city vote for nine men. This means that there are six Democratic nominees, six Republicans, and so on; six nominees for each party; one from each district, but all are candidates-at-large. Now when a Republican (for instance) has voted for the six Republican nominees (as the average partisan voters would do) there are three more candidates to vote for. So he selects, from another party, or other parties, the seventh, eighth and ninth of his choice.

You can readily see two unusual features of the council elected under this law. One is that it is possible for some district to be left without a representative—possibly, but not probably; and even if it turned out so, the at-large feature would prevent any unfairness. The other feature is that the council cannot by any chance be composed exclusively of members of a single political party; there are bound to be at least three of the party not in power in the city, and possibly more than three. This is the chief novel feature of the council.

Now as to the mayor. People are likely to say that he has too much power and too much responsibility. It is likely to seem so to the mayor, too. I, for one, felt the responsibility very seriously, under the charter of 1891. The mayor is not only responsible for the acts of the four boards before mentioned, but for all the appointees of those boards. It is not a plan universally approved, but I believe it to be the only correct one in this age of great public works.

It means that when a man is elected mayor, all he has to do to keep out of trouble and be successful is to appoint honest and capable men on his boards. If perchance anything goes wrong in spite of all his care, it is the easiest thing in the world for the mayor to obtain the public's pardon by discharging the man or men who have failed. I was one of those obliged to do that; I requested the resignation of a board and appointed another board in its place. That the mayor has absolute power to remove, is the strong point of the federal system and the success of the plan. It sounds dangerous, but it is the reverse and is a good plan for a progressive city.

As to public improvements conducted by the Board of Public Works. The charter of 1905 provides that where a street (for instance) is to be improved, and an assessment district therefor is established, if anyone is dissatisfied with his assessment he has a right to apeal from the levy to the court. That is, he could file a complaint against the city. The court would immediately appoint three appraisers, who within three days would report to the court the amount of benefit which would result to the plaintiff. If the appraisement fell 10 per cent. or more below that of the Board of Public Works, the court would award to the plaintiff a reduction of his assessment and the city would have to pay the difference between the original assessment and the one fixed by the court. This law was upheld by the supreme court. Under it a case is tried as any other issue is tried, the court deciding on the evidence.

But there is very little tedious litigation arising out of improvements by the Board of Public Works. The proceedings of the board are, furthermore, the most expeditious imaginable, and one feature is especially commendable. The board can start, carry through and finish an improvement all within two months, notwithstanding any opposition of property owners. The work goes on in spite of protests, and the protest also may go on (by suit brought in court as already described) at the same time. The protesting property owners are awarded damages (if really damaged or excessively assessed) but they can not tie up the improvement proceedings.

Ater a careful study of the federal system of municipal government, I have tried to sketch for you, I made up my mind a few weeks ago that another improvement can be made in it —at least as applied to Indianapolis and the county of Marion. I commend the improvement to you here also in case you ever wish to discuss a city-and-county government.

Indianapolis covers more than a township; it covers and contains about nine-tenths of the county's population, and more than nine-tenths of the assessed valuation. Therefore I think there is no sense in continuing two separate governments.

The federal system can be applied to both the city and county just as well under one set of officers as under two. The two together can be better conducted by even a smaller number of officials than the city alone has today—better and much more economically. I know it can be done in Indianapolis and Marion county. I believe it can be done here.

There is no provision in Indianapolis for the initiative, referendum or recall, though they were discussed and strongly urged. The only provision in the charter for removing an official is by impeachment—a harder system to make effective than yours here. The recall would work well with the federal system.

SOME EXPERIMENTS ON THE DURABILITY OF CEMENT DRAIN TILE.*

By Prof. W. H. Day, Agricultural College, Guelph, Ont.

SINCE the Ontario Agricultural College began college extension work on the subject of farm drainage some five years ago there have been numerous inquiries for information on the subject of cement tile. People usually wanted to know two things: first, whether the cement tile could be made cheaper than the clay tile, and second, whether they would be durable. When these inquiries first began to come in there were not, so far as I am aware, any extensive or conclusive data as to the durability of cement drain tile, nor was there any grave question about their durability. There was a general impression, however, that they should prove durable, judging from the manifold conditions in which concrete had proven its usefulness.

In the latter part of the year we learned of the controversy over the durability of the cement drain tile, and we must confess that the idea of cement being soluble was a new one to us. After reading the attack on cement and the answer to it we counselled our farmers to go slowly in the adoption of cement tile, believing that the uncertainty in our own minds at least about their durability was sufficient to warrant such action. At the same time, however, we decided to conduct some tests in order to learn for ourselves something about the solubility of cement, and to deduce from the information thus obtained some idea of the probable durability of cement tile. Those experiments were begun in February, 1909, and have been continued until the present time. Besides the points already mentioned, the porosity of cement tile received some attention during our experiments.

Experiment I.—Sample, a piece of tile weighing 43.256 grams, after being dried to constant weight at 215 degrees F. This tile was made by the "dry process" in April, 1908, in proportions 6 of sand to 1 of cement. For a few days after being made it was watered daily, and then it was submerged in water for a period of six weeks, after which it was removed and transferred to a storage cellar, where it remained until solubility experiments began. Tile quite porous. After the small piece had been dried to constant weight it was placed in distilled water for four days, then removed, dried, weighed, and again placed in fresh distilled water. As convenience allowed it was dried, again weighed, and once more placed in fresh distilled water. This was repeated 16 times, the total period of solution being 148 days and the total loss in that time was 0.113 grams. The total cement in the sample was 7.174 grams, hence at this rate the cement would all dissolve in 27.7 years. The experiment was next performed with water from the artesian wells at the college. This water is high in total solids, about 460 to 480 parts per million, made up chiefly of bicarbonate of calcium, bicarbonate of magnesium, or the compound bicarbonate of calcium and magnesium. There is also a small amount of chlorine in it. The sample was tested five times in this water, the total period of solution being 47 days and the total loss in weight .090 grams. At this rate it would take only 10 years to dissolve all the cement in the sample.

*A paper before the Canadian Cement and Concrete Association.

Experiment II.—Sample, a piece of tile, proportion 6 to 1, made on London two-piece machine May, 1908, watered daily for a week after making, stored in cellar till November, 1909, mixed much wetter than sample used in experiment 1, so wet, indeed, that the molds would not clean well. Dry weight 43.213 grams. The treatment was the same as in experiment I, only the number of tests in distilled water numbered 8 instead of 16, the total period in the water being 73 days. During the period the sample lost .025 grams, at which rate it would take 57.4 years to dissolve all the cement in it. When put in the well water the loss in 47 days was .090 grams, which rate would use up all the cement in 10.3 years.

Experiment III.—Sample, a piece of wet mixed tile, made the same time as No. 2 and watered and stored in the same way. Dry weight 36.2795 grams. Treatment, distilled water for 73 days, well water for 47 days. This sample lost only slightly in distilled water and gained .0333 grams in well water. At this rate it would last forever.

Experiment IV.—Sample, a piece of tile, proportions 4 of sand to 1 of cement, made by Mr. George Holden, of St. Marys, on the London Automatic cement tile machine. Watered daily for a week after being made, and then stored in our laboratory until October, 1909. Dry weight 20.4792 grams. Treatment, same as II and III. Loss in distilled water in 73 days=.0387 grams. At this rate the sample would last 26.5 years.

Experiment V.—Sample, a piece of tile, proportions 4 of sand to 1 of cement, made by same maker as No. II, cured and stored in the same way. Dry weight 35.781 grams. Treatment, same as others. In 73 days in distilled water the loss was .0175 grams, at which rate the sample would last 102.2 years. In 47 days in well water the sample gained .0165 grams in weight, and thus would never disintegrate.

Experiment VI.—Sample, a piece of clay tile, about average quality, possibly burned a little slack. Dry weight 36.660 grams. Treatment in distilled water 48 days, weighed 5 times, in well water 47 days, weighed 5 times. Loss in distiiled water 1.159 grams, at which rate the sample would last only 9.1 years. Loss in well water .081 grams, at which rate the sample would last 58.3 years.

In estimating the time that sample would last it has been assumed that they would be subject to solution 365 days in the year and that the rate of solution would be uniform. The first of these conditions certainly would not hold in practice. During a large portion of the year, possibly half, tiles are dry and not subject to solution, and consequently would last twice as long as the periods mentioned, provided the rate of solution during the other half of the year was constant.

We had hoped to establish something definite as to the rate of solution, but we have failed to do so yet. The rate of solution seems to fluctuate with some factor other than time, probably temperature. Just when our curve for rate of solution would reach a constant for two or three readings, this variation would occur and prevent conclusions. In all samples the rate of solution in distilled water appeared to fall off, slowly in most cases, but very rapidly in a few, especially in the case of the clay tile. When placed in the well water the samples all behaved irregularly at first, giving either large losses or else large gains, and these losses or gains fell off rapidly.

Three other experiments were performed which probably come nearer natural conditions than the previous experiments do. Three half tiles were placed in water on May 6, 1909, where they have been ever since. At the end of six months they were dried, weighed, replaced in the water. Then last week they were dried and weighed again. The results are as follows:

Experiment VII.—Sample, a half tile, proportion 6 to 1, made on London two-piece machine, dry process, May, 1908, watered for a week, stored in cellar. Dry weight 1797.5 grams. Treatment, in running well water for 10½ months, weighed at 6 months and at 10½ months. Result, tile gained in weight each time. Total gain 3.4 grams.

Experiment VIII.—Sample, same as in 7. Dry weight 1910.25 grams. Treatment, same as 7. No change in weight in first 6 months, a gain of 4.05 grams in next 4½ months.

Thus these two samples would never disintegrate at this rate.

Experiment IX.—Sample, a half tile, proportions 6 to 1, made on London two-piece machine, made very wet, so much so, indeed, that tile would not hold shape, and molds would not clean. Allowed to dry, getting a few showers of rain, and then stored in cellar. Dry weight 2001.0 grams. Treatment, same as in 7 and 8. Tile lost 1.90 grams first 6 months and 2.7

grams next 4½ months. At this rate the sample would last 63.4 years.

It is worthy of note with regard to these three samples that those made by the dry process, and therefore very porous, were the ones to gain in weight, while that made by the wet was the one to lose.

The behavior of these three large samples contrasts so strangely with that of the small samples as to indicate that experiments with small pieces are apt to be very far from actual conditions. For instance, the rate of solution for the piece of clay tile would indicate that that sample would all dissolve in less than two generations. And in much less time than that the tile would be so weak as to give way under soil conditions. Experience has shown that such does not occur, and hence we must conclude that the conditions are so artificial that it is not safe to base arguments as to durability upon such tests. It is even doubtful whether the large tile in running well water is very close to natural conditions. In the soil there will be much very fine sediment in the form of clay and colloid particles to lodge in the pores and prevent solution. The process of accretion shown in two out of three of these large samples would doubtless be much more rapid in the soil. Another reason for the slower solution in the large samples was the cooler temperature maintained by the constant introduction of cold water. Basing our conclusions on these larger samples we are not able to see any danger of the cement tile crumbling.

Porosity.—With regard to the porosity we find that it varies with the proportions of cement, with kind of sand used, and also with the method of making. The more cement used, the finer the sand, or the wetter the mix, the less porous the tile. But even the most compact ones tested were much more porous than clay tile.

RELATIVE EFFICIENCY OF DAY LABOR AND CONTRACT SYSTEMS OF DOING MUNICIPAL WORK.*

By Charles R. Gow, Boston, Mass.

IN the first place, the rate of wages paid for foremen and superintendents in municipal and most government work, is as a rule, I think, less than is paid by the large contracting concerns doing the same work on the same scale, and that would mean, of course, that a much less efficient class of foremen would be carried by the cities than by the contractors. We have found from experience that some foremen are cheap at $10 a day, while others who might be willing to work at from $2.50 to $3 a day, would be very expensive. As an illustration, I once worked as superintendent of a large contracting concern in New York. They had previously done railroad work, and they were engaged at the time on the construction of one of the large subway sections there, and brought on a lot of these foremen to handle that work. And the first criticism I made after looking over the work was that they did not have a sufficient number of competent and experienced foremen. I was told to hire any foremen I knew who were suitable for the work, but when I mentioned the fact that we should probably have to pay $150 a month for such foremen as I had in mind, the president of the company threw up his hands. After considerable argument he finally agreed to allow me to engage two such men as I wanted at that salary. The first of these men who happened to appear on the work was put in the place of a $3 man. And his first act was to discharge six men out of the gang, and in his first day's work the result was an increase in output of 25 per cent. And this increase in output, as I remember it, represented a value of something like $35 to the contractor. That would illustrate in a way what I mean when I say that the high-priced foreman is oftentimes cheap in the end.

The cities, of course, establish a fixed rate for their foremen as a rule. There is no promotion by merit, and there are seldom any questions asked as to the ability of the foreman, provided he comes with the proper credentials from the civil service or other department. Of course, the average laborer will do no more work than he

*A discussion of H. P. Eddy's paper before the Boston Society of Civil Engineers, similar to the one on p. 76 of the February number of MUNICIPAL ENGINEERING.

is required to do, whether he is working for the city or for a contractor. And unless he has competent supervision the results cannot be expected from him. The political aspect of city labor was pretty clearly dealt with by Mr. Eddy. Of course, its demoralizing effect is unquestioned. It was in order to correct the evils of political control that the civil service system was inaugurated, and yet to my mind that is even a greater evil as regards labor in efficiency than political control. When, some years ago, I was acting as superintendent for the Boston Transit Commission, in charge of their contract labor, we had some six hundred men employed. That was on the original subway, doing some special work where it was adjacent to buildings, or in localities where it was feared the contractors might lead the commission into difficulties. We were obliged under the law to procure all the labor from the civil service list. And the most difficult feature of the whole undertaking was to secure a gang of men that we could do anything with at all. The trouble seems to come in this way. The good men, the efficient men, are seldom out of work for any great length of time. The value of their services is well recognized by contractors, and as soon as they finish up one job they secure other work, if there is work being done. Consequently they don't take the trouble to register with the civil service commission and wait their turn before they are certified for employment. The majority of the men who do register with the civil service commission are men who can't find employment in any other way and simply look upon the city as a good asylum from which to obtain an easy living. The result, as we found it, was that if we wanted 25 men to start a piece of work, we would make requisition for 100, and out of that 100 probably 50 would appear with high standing collars and patent leather shoes, and some of them on crutches or otherwise disabled. And we would be expected to select from that crowd a gang of men to go down 25 or 30 feet below the surface of the ground to brace trenches and excavate in wet and difficult ground. I can readily understand where the city departments may be seriously handicapped on that account and where a really conscientious official would have serious difficulty in obtaining a gang of men that would be suitable for his needs.

The next evil that suggests itself is the influence of labor unions. The labor vote, of course, is of such consequence that it can't be ignored by political officeholders if they expect to continue in office. And the result is that labor councils have been allowed wide latitude in dictating the details of labor administration. It is one of the avowed principles of the labor unions at the present time to so regulate the output of men as to make positions for the largest number of men possible. And they consider it perfectly legitimate to so cut down the output of one man as to make room for a second one doing the same work. Of course where this is allowed to prevail, as I believe it is largely in the city employ, it can't be expected that efficient service can be maintained.

Then there is the question of discharging men in the city employ. Now that they are under the protection of the civil service, it has become a matter of considerable difficulty for a foreman to get rid of an inefficient man. And I can readily see where all these things combined can tend to raise the price, as Mr. Eddy has shown. The matter of employing citizen labor is very fine in sentiment, but it hardly makes for economy. The contractors found long ago that the available supply of English-speaking labor was practically exhausted, that is, the supply of competent labor. And they were obliged to turn to foreign labor, not so much as a matter of economy, as a matter of necessity. My own experience is that we pay practically the same rates of wages to the competent foreigners that we do to equally competent Irishmen or Americans. And while we would much prefer to have the English-speaking man to the foreigner, we find it impossible to obtain a sufficient number of competent men. And, as a matter of fact, the Italian labor at the present time is becoming scarce. The better class of Italian laborers today can command and receive $2 a day, when business is good, for common labor. We pay some of them who are skilled a little beyond the average as high as $3 a day. We pay a minimum wage in our company of 17½ cents an hour, and an average for common labor of probably about $2.10, which is not a serious handicap to day labor as a matter of competition.

I am inclined to take issue with Mr. Eddy as to the possibility of day work being done better than contract work. My experience and observation lead me to a different conclusion. I have noticed that where day labor is in

vogue, as a rule there is no inspection, and where there is any conscientious endeavor to do the work cheaply, it is carried to the same extreme that a contractor is apt to carry his work in doing it cheaply. I have in mind an instance I noticed a few years ago in one of the cities nearby where bids were asked for the construction of a covered waterway, a brook channel, I think it was. And for some reason all the bids were rejected and the work was done by day labor. In that case there was an inspector on the work who appeared to me to be a little more ambitious to hustle the work along and to do it cheaply than even the foreman himself. Most of his energies were given to pushing the work. On that particular piece of work there was a concrete arch, very flat, as I remember it, and not more than 12 inches in thickness. And at the time I noticed the work they were concreting this arch and imbedding in it field stone as thick as they could get them and still have them come within the limits of the sections. Now, so far as I know, no serious trouble has occurred from that type of construction, but I rather imagine that if a contractor suggested that to an inspector or an engineer he would be told a few things. There are several other cases I have in mind where contracts have been called off and bids rejected and the work subsequently done by day labor and the engineers or inspectors, having the contract price which they must not exceed, have stretched their consciences materially to keep within the limits under the disadvantageous conditions they were put to by the labor situation and expense.

As a general thing, in letting contracts, the disadvantages that Mr. Eddy referred to, and which I admit are considerable, could largely be overcome if the engineers would show a little more courage oftentimes in rejecting low bids and the bids of incompetent parties, and insist, as far as they are able to do so, on awarding the work to competent parties at what would be a fair and living price. We all of us make mistakes in our bids. We often overlook important items. You understand, of course, that the working engineer has had months, perhaps, to think over the problem and to think over the obstacles and the difficulties to be encountered, while the contractor is obliged to form his judgment in a few days, and oftentimes the best of contractors make serious mistakes in estimating the work, and consequently bid ridicuously low. Of course, there is a certain spirit among contractors as well as other business men that makes them feel like standing up and taking their medicine under such circumstances. And oftentimes they would appreciate a suggestion from the engineer that he would like to have them retire under the circumstances and allow him to award the contract to a higher bidder. It is not impossible to find out by a proper investigation just what the ability of the contractor is and whether the work in question is beyond the limit of his ability. It seems to me that it would be perfectly proper, and should almost be deemed necessary under the circumstances I have outlined, to advise the awarding of the bid to some other contractor. And if this were done in all cases I think that the difficulties that arise out of contract work in some cases could be largely overcome.

The question of day-labor versus contract work will probably never be entirely settled. It is probably generally admitted that day-work must cost more than contract work. But there is a question whether or not, in a certain measure, the public does not wish to accept the conditions as a concession to policy and sentiment, provided the difference is not excessive.

VALUATION OF WATER WORKS SYSTEM OF RICHMOND, IND.*

By Howard A. Dill, Engineer and Superintendent.

IN presenting the subject covered by this paper, it is necessary to give a brief history of the Richmond plant. This company was incorporated in 1883, with a capital stock of $250,000.00. A franchise was granted by the city, and a contract made for seven years covering hydrant rental. The plant was put in operation in 1885 and carried a bonded indebtedness of $200,000.00. On Sept. 21, 1892, a new contract was made for

*From a paper before the Indiana Sanitary and Water Supply Association.

twenty years. The plant in 1885 comprised a brick pumping station, two and one-half miles from the center of the city, containing a four-million Holly pump, two 80 horse-power boilers and necessary piping; a ten-million-gallon reservoir with bouldered inner slopes, located one mile beyond the pumping station; a twenty-inch main connecting the reservoir and pumping station; an infiltration gallery 300 feet in length; a twenty-inch main to the city, and a distribution system with twenty miles of mains from six to sixteen inches in diameter, 170 Mathews hydrants with six-inch branches and about eighty valves. Since the installation of the system in 1885, three additional galleries have been built, aggregating 1,225 feet in length, and a sixteen-inch cast iron siphon line three miles in length conveys water to the pumping station from a large dug well. Another Holly pump of six million gallons capacity was installed in 1894 and two boilers added. The reservoir has had the bottom and inner slopes cemented, and the distribution system has been gradually extended. All parts of the plant have been kept in good condition, and Mr. Dabney H. Maury, who was recently engaged by the city, reported that "the plant as it now stands is in almost every respect above the average for cities the size of Richmond." Its present length of mains is 37.34 miles of cast iron pipe from 3 to 20 inches, and three miles of wrought iron pipe from ¾ to 3 inches diameter. This does not include 4,713 feet of 20-inch pipe from pumping station to reservoir. On July 1, 1909, there were 312 Mathews hydrants, 2,360 meters, 4,281 service attachments in use, 23 fire lines and 112 free services for supplying water to school buildings, hose houses, drinking fountains, flush tanks, etc. The consumption for the year, same date, was 778,000,000 gallons, of which 351,000,000 gallons were metered. The estimated free water was 60,000 gallons for the year.

In March, 1908, a fire occurred in a downtown business block, originating in a large stock of paint, and after several hours' work, was gotten under control with a loss of $60,000.00. Thirteen streams were used under direct pressure. As a result of this fire, the Commercial Club took up the matter of additional fire protection, covering a second main, another pumping engine, an additional hose company, more fire apparatus and a building code, following very closely the requirements of the State Fire Inspection Bureau's conditions, by which Richmond could be placed in Class 2.

A conference was arranged between the Board of Public Works and the company, and a proposition was made by the latter to cover above requirements, provided a new contract was entered into, the rates therein to be practically as heretofore. The Board of Works considered the proposition unsatisfactory, and decided to employ an expert engineer to review the situation. Mr. Maury, of Peoria, Illinois, was engaged by the city, and the company retained Mr. John W. Alvord, of Chicago. The city desired the company to give it such data as would enable it to obtain the value of the plant. Being confident that the city was acting in good faith, and wishing to convince a doubtful public that it was not seeking a return on an inflated stock and bond issue, the company opened its books for examination by the city's accountant. The action of the company met with hearty approval, and it was agreed that the engineers should work in conjunction in securing the inventory of the plant. There could then be no dispute on the items of facts. Any differences arising would be on valuation only. The preliminary work of the engineers consisted principally in checking and tabulating the data furnished by the maps, records and inventories of the company. Information as to character of excavation, street pavements, etc., was obtained from the city engineer. The work of the accountant consisted in reviewing and auditing the receipts and expenditures from 1904 to 1909, and in examining the investment or plant account from date of organization, to see if the entries therein were properly charged to such account. The company has always been conservative in entering up the cost improvements on the plant account, and depreciation has been taken care of by charging repairs and replacements to the repair account. Under this system the books of the company on July 1, 1909, showed a plant valued at $553,331.20.

The report of Mr. Maury was made to the Board of Works in November, 1909, and included a complete inventory of the plant, valuation of same, report of the expert accountant, and recommendations for betterments. In determining the present value of the plant, Mr. Maury and Mr. Alvord took into consideration the cost of reproducing the property, which plan seems to be growing in favor as a most equitable one. Two years were estimated

as necessary to complete the new plant, and two more years to secure a revenue equal to that acquired by the existing plant at the expiration of the same period. Under this method, the cost of reproduction of the physical property is given as follows in Mr. Maury's report:

Description.	Cost of Reproduction.	Depreciation.	Present Worth.
Preliminary costs	$10,000.00	$1,088.00	$8,912.00
Real property, water rights and rights of way	37,400.00	.....	37,400.00
Interest on real property, etc., during 1½ years' construction	2,805.00	.....	2,805.00
The distribution system	328,436.39	27,094.12	301,342.27
The reservoir	50,508.44	3,737.62	46,770.82
Pumping station	65,517.55	13,956.12	51,561.43
The water supply	73,618.87	9,581.97	64,036.90
Meters, stock tools and other property	42,348.89	7,564.29	34,784.60
Engineering 1½ years' construction	30,531.76	3,150.88	27,380.88
Interest during construction	24,418.76	2,520.02	21,898.74
Cost of reproducing the property	$665,585.66	$68,693.02	$596,892.64
Going concern value	110,825.69	.....	110,825.69
Operating capital	10,000.00	.....	10,000.00
Total cost of reproduction	$786,411.35	$68,693.02	$717,718.33

Mr. Maury's recommendations for betterments cover a new pump, suction well, increase of water supply, a 20-inch main to the city, additional mains to improve circulation, and additional valves and hydrants, the total being estimated at $139,000.00. Mr. Maury estimates that the present net earnings would yield 8.34 per cent on the physical value of the plant, 6.94 on the valuation, including going concern value, and 5.18 per cent on $857,188.33, which includes the above physical and going concern values, and the amount invested for betterments as recommended.

As the Board of Works, to whom the report was submitted in November, was to retire January 1, 1910, no action was taken, except to make a report to City Council, in which it highly commended Mr. Maury for his excellent report, but took exception to the going concern value and charges for depreciation.

The report of the Board of Works claimed that as the contract of the company expires in 1912, there should be little, if any, allowance made of the plant as a going concern. Some confusion seems to have existed between good will and going concern value. Even if all rights of the present company ceased at any definite period, the going concern value would still exist, for if the city undertook to reproduce the property, it would sustain a loss in revenue estimated by Mr. Maury and Mr. Alvord as $110,825.69 before the new plant acquired a business equal to that of the existing plant. Legal decisions warrant such a valuation.

Many of the most eminent hydraulic engineers include such values in their estimates. Mr. Benezette Williams says: "Going value is inherent in the plant, and is a part of it just as truly as the cost of machinery and pipes is a part." The Wisconsin Utility Commission says: "The courts have almost universally held that this element is an important and valuable consideration, which cannot be left out of account in fixing the fair value of the property of a public service corporation devoted to the public service."

The Board of Works, in commenting upon the estimate of depreciation, contended that as the ordinary average annual rate of depreciation on waterworks plants, taken as a whole, is about 2½ per cent, the same per cent should be applied in this case, and, figuring the average investment for the twenty-four years of the company's existence as $500,000.00, determined the depreciation July 1, 1909, as being $300,000.00. And yet the plant is regarded as one of the best of its size. I assure you, gentlemen, that it is still very far from being ready for the junk heap.

What will be the outcome of the investigation, the writer cannot state, but it is certain that the friendly action of the city and the company has greatly improved the situation locally, and whether the city purchases the plant, or enters into a new contract, it is certain that the recent valuation has facilitated the adjustment of any differences that may have existed.

EDITORIAL COMMENT

Floods and Forestration.

The Relations of Railways to the City Plan.

FLOODS AND FORESTRATION.

The discussion of the relations of rainfall, forests, stream flow, conditions of navigation at various seasons and the like is at times quite acrimonious and at the same time, perhaps, as a consequence, is far from satisfactory from any point of view. The problem is a very large one and has many variations and conditions, and, thus far, each writer on the subject has attacked it solely from the point of view of his own experience and has selected from the miscellaneous mass of unrelated, defective and more or less incorrect data available such as sustain him in his own conclusions.

As a consequence there are as many opinions as there are writers, although they range themselves in two opposing groups, which may be roughly described as believing that forests have or do not have material effect upon the navigation of our navigable rivers. To be sure, there are some who would state the differences in position in very different language, almost so different as to be unrecognizable, but the above statement is that which comes the nearest defining the position of those most closely interested from the political point of view.

This entrance of political prejudices into the question is extremely unfortunate and as long as it remains as prominent as it is at present progress will be delayed if not stopped entirely. Possibly this political element arose from the efforts of those interested in forestration to secure appropriations from Congress and the consequent fear of those interested in the improvement of navigation in the streams that their appropriations would be diminished, especially since the advocates of forestration have made rather rash claims that their work would obviate the necessity of so much stream improvement. It is easy to see how a contest could arise which would have had no reason for existence if there had been the co-operation which the magnitude of the problems and their equally great importance make necessary for the proper treatment of both. They are closely related, if not so interrelated as to be inseparable, and neither one, but especially the newer problem of forestration, has had the continued and broadly extended study which their importance requires. It is also easy to see how the slightly informed (for there are no really well-informed) partisans of each side should rush into Congress with arguments designed to influence the people and the legislators, rather than to present unbiased, careful statements of fact and careful statements of conclusion hedged by admissions of the vast lacunae in the unrelated bits of available information.

Were personal recollections admissible the writer could add some which would bring into the discussion points which have not yet been touched and which would corroborate statements made by partisans on both sides, but this would only add to the confusion and would aid only by setting down a few more facts and principles which must be considered when the complete study is made.

It is to be hoped that the discussion will soon assume a more temperate, a scientific tone and that some one with leisure and ability will attack the problem in a way to include both sides and bring out the necessities for both sides in the non-partisan, truly scientific manner which will carry conviction. Undoubtedly the result of this discussion will be to demonstrate the need of both stream improvement and

water-shed improvement, and their inter-relations, and only time and conscientious, united effort can show the best methods of meeting the individual needs of each river, stream, mountain or valley.

THE RELATIONS OF RAILWAYS TO THE CITY PLAN.

The American Institute of Architects has done a great service to the cause of better planning of cities and the revision of plans of our larger cities to suit modern conditions by bringing together for thorough discussion of the problems of the relations of railways to city development a number of experts from among the railway managers and engineers and the architects and publishing the papers and discussions in a special volume, which can probably be obtained from the secretary of the Institute Glenn Brown, Washington, D. C.

The problem is much more complicated than would seem probable until it has been studied. President Delano of the Wabash railroad read the first paper and called attention to the differences in topography as making the most pronounced differences in the solutions of the problem for various cities. Height of buildings, with the concentration of people in the districts of high office buildings; the methods of housing the population, whether in tenements down town or in houses farther out; the size of the city, and the fact that the smaller cities want the railroad stations, especially the passenger and mercantile freight stations, as near the center of the city as possible, are other important factors, according to Mr. Delano.

And the character of the passenger and freight traffic also makes a material difference in the treatment of the problem of terminals. Thus rapid transit trains within the city and immediate suburban limits; interurban electric traffic, which is omitted from Mr. Delano's consideration; local trains; through traffic; whether the city is a terminal or a way station, or both, require differences in treatment. Then, too, the freight service to and from the mercantile districts, the manufacturing districts, the building and other bulky material districts demand differences in treatment.

In the large cities there is now a strong tendency to make the distribution of both freight and passenger traffic from the railroad terminals to the congested districts by tunnels or subways.

Mr. M. A. Long, architect for the Baltimore & Ohio railroad, treated the subject from the point of view of the plan of the freight houses and tracks, their architecture and the arrangement of in and out-bound freight, cars and tracks.

The vast Hudson Terminal Station in New York and the handling of passengers and baggage and their transfer from trains to rapid and other city transit lines were described in considerable detail in a paper by J. Vipond Davies and J. Hollis Wells. The service by tunnel and subway to the station are well developed, as well as the financial reasons for the construction of the great office building over the station. The latter are mainly based on the economic necessity of raising sufficient income to carry the heavy investment in land under which to construct the station. The problem of station stairways is treated in this paper also.

John R. Rockart, architect, and I. D. Waterman and C. W. Lord, engineers, for the New York, New Haven & Hartford railroad, show the relations of the railroad buildings, retaining walls, bridges and their surroundings to city development. The wonderful work done in Washington in fitting the railroad structures to the beautiful city plan; the fitting of the railroads and stations along the Cleveland lake front into the civic center plan; the relation of the railroad station and tracks to the proposed New Haven, Conn., improvements; and the work in foreign cities, such as Paris, Genoa, Hanover, Budapest, are set forth briefly; also the defects in such large schemes as the terminal stations in Boston, the new Pennsylvania station in New York. Some of the difficul-

ties and successes in the treatment of the small suburban or through stations within the city limits or the well-populated suburbs are also shown.

The lack of study of the problem of distribution of freight is deplored and the Chicago plan for a central freight terminal, where the carloads will be broken up and the freight distributed in the district by subways, is mentioned. The use of electricity in moving the traffic within the city limits is asserted to be more economical than the use of steam.

Mr. George Cary, the designer, described the plans for the new Buffalo railroad terminals. Mr. Albert Kelsey discussed briefly interurban stations and trolley traffic in city streets.

The entire series of papers is well worth close study, and, while none of them are complete, and but few are so thoroughly worked out as to disarm criticism, they show, as a whole, the great importance of the problems and what have been the successes in the treatment of a few of them. One can read between the lines the probable success or failure of others among the projects still under discussion.

THE QUESTION DEPARTMENT

Is This a Valid Contract, and How Can Compensation Be Secured?

I enclose you outline of controversy pertaining to contracted work performed by me, as I know you have a legal department connected with your publication, which I read monthly, and it is possibly posted from experience in such a case, and can easily answer it. Attorneys here give exactly opposite opinions—that I can hold the land as per verbal contract, and that I can be ejected and verbal contract will not hold. A., ———, Ill.

"A" (a contractor) agrees with "B" (manager of a gas and electric light company, a corporation) to do certain concrete work for $855, one-half of price, $427.50, to be taken in land on which "A's" factory is located, and one-half contract price cash, $427.50. Entire plat of ground consisted of about three acres, purchased by "B" for $3,000. "A's" share was to be at this rate or 427.5 three-thousandth of the plat.

"A's" said contract with "B" was an oral contract.

"A" performed said contract for "B," which was accepted. During past two years "A" has performed work for "B" with material amounting to about $3,800 total. Head officers of said corporation again and again promised to execute and deliver said deed. This promise to deliver said deed was made by the manager and other officials of the corporation and everything was satisfactory. This contract was never put in writing, although both "A" and "B" agreed to draw up said contract in writing.

In the five years last past "A" has constructed work in this city and vicinity to the value of about $5,000 under verbal contracts only and had never found it necessary to use written contracts which appear to cause suspicion of bad faith here, a gentleman's agreement being apparently preferable.

The last check given by "B" to "A" in payment for work performed called for balance in full, including the $427.50 which was to be paid in land. "A" received this check, upon advice of counsel, under protest and at the same time notified said company that he expected said company to keep said oral agreement in regard to said land deal and deliver deed for the $427.50 which he held for them.

The attorney now acting for said company has acted during the past five years as the attorney for "A" under a general retainer paid by "A" and accepted by said attorney.

Now said attorney for said company says that said agreement concerning said deed is void because not in writing. Is this the law under these circumstances?

The same attorney also says that even if said agreement had been put in writing it would be void unless signed by the board of directors or proper officers (other than the general manager). Is this the law under these circumstances?

During these last 24 months or more "A" has carried "B" for $800 to $1,600 without interest, borrowing at bank to do so. Now said company threatens ejectment proceedings unless "A" signs lease for land occupied by "A's" factory.

Said portion of land is more valuable now than at the time said agreement was made. "A's" factory is on railroad transfer and such another place is not to be obtained in the city. It would cost "A" several hundred dollars to move his factory even if he could get a place or location.

"A" had erected his factory upon said location previous to the time "B" or said company made said purchase, but after said purchase and said agreement for

deed was made, "A" made a number of improvements to his said factory. Never paid any rent to said company and never agreed to do so.

Questions:

Can "A" compel specific performance and get deed?

Is the use of said check a bar to "A's" action?

Can said attorney act for the company in this matter?

Did not "A" "fully perform" and thus take the case out of the statute of frauds?

Has "A" any action against the company Against said attorney? What kind of an action? Has "A" a claim for damages, and if so, for how much?

MUNICIPAL ENGINEERING is greatly ocmplimented that the opinion of its legal department is so highly esteemed, but must feel that its opinion can scarcely be as valuable as that of attorneys on the spot, fully acquainted with Illinois laws and with the parties to the controversy and doubtless with more or less of the facts involved.

In general, the rights of an officer or employe of a company to bind the company are limited to such classes of acts as are authorized in a general way or acquiesced in by the board of directors. They may very well cover the ordinary payment of a contractor for services rendered under a verbal contract, when they would not cover payment by the transfer of the title to a piece of land. If the company contests the method of settlement named, the burden of proof will rest on "A," and all the facts in the case, including those mentioned. and others, such as the custom of the company in leaving this and like matters of business to the manager without specific delegations of authority, will aid the court in making his decision.

The actions of the attorney seem to be such as should be governed by the ethical standards of the profession, and flagrant violations are punished by proceedings for disbarment in cases which specific statutes do not reach.

Should City Contract for Electric Power?

Would it be considered wise for a municipality that already owns her utilities, water, gas and electric plants, to enter into a twenty-year contract with a private ownership corporation, for the purchase of power?

With coal at $2.25 to $2.35, under some adverse circumstances, we are producing power at 1¼ cents per kilowatt hour, as claimed by our superintendent. A limited near-by water power, that can only harness and generate from 300 to 600 horsepower desires the franchise on the general public proposition "we will do it for 25 per cent. less than city is now paying."

With a growing country and increasing population with a wider demand for current, would not a general statement like this, meet a different construction or opinion in an other administration, or generation, and result in trouble? And do not the city's franchises grow more valuable, and the rapid economic discoveries in electrical development make a term contract a dangerous proposition for a municipality to enter into?

We desire unbiased facts, as well as the possible troubles an arrangement of this kind is likely to encounter. V.

This is a question which probably requires some direct study of the local conditions and the plans and possibilities ahead of the water power company, made by an engineer expert in this sort of work, before an intelligent answer can be given. It should be possible to make a good contract, with terms allowing for modifications in its provisions as conditions change, provided the private water company is made up of responsible people, has ample water power to meet all its engagements and can enter into bond which will indemnify the city for any losses or damages due to failure of the company to fulfill its engagements with the city. The city should also have the first right to power under its contract with the company, so that, in case of partial failure of power from any cause, the city will receive its service first and other customers will be served only after the necessities of the city have been met.

Even with ample guaranties it would be far the safest and most satisfactory for the city to have the project investigated by an expert engineer acting for it, and the services of such an engineer will be worth many times their cost if he has a large voice in determining the terms of the contract, or if he finds that the company is promising impossibilities in the hope of coming out ahead on account of the lack of technical information by the city's officers.

Names of such engineers will be found in each number of MUNICIPAL ENGINEERING in the "Business Directory" under the headings "Civil Engineers" and "Consulting Engineers."

Expediency of a Municipal Electric Light Plant.

In your March MUNICIPAL ENGINEERING you refer in response to a reader's query to several issues that contained special articles on the cost, construction and maintenance of municipal light plants I am interested here in starting a discussion before the public upon the expediency of putting in an electric light plant and would be glad if you will refer me to numbers containing articles especially with reference to such a matter.

V., ————, Ky.

The best basis for such a discussion would be a report from an engineer giving a general plan for a lighting system, with approximate estimates of cost of plant and cost of operating it. This would give definiteness to the proposition and would save much misunderstanding and misrepresentation.

The current volume of MUNICIPAL ENGINEERING contains several articles of value in this connection, especially those on pp. 44, 169, 186, 249, 330, 335. Articles on pp. 107 and 346, also give references

to many previous articles directly applicable to such a discussion. They cannot, however, give the definiteness of a report applying directly to the case and based on some study of the local conditions. See also the article in this department on "Cost of Operating Arc Street Lighting System."

Current Used by Incandescent Lamp.

By burning two sixteen candle power incandescent electric lights 8 hours each day for a month of 31 days can you tell me how many kilowatt hours that would amount to?

This last month I used two lights as above for eight hours each day and the electric light company has me marked up as consuming 39 kilowatt hours. Is that correct? H., Snohomish, Wash.

Estimates of the efficiency of incandescent carbon lamps vary from say 40 to 65 watts per 16-c. p. lamp. For two lamps burning 248 hours per month the consumption of current would therefore vary from 19.9 to 32.2 kilowatt hours. If two lamps consumed 39 kilowatt hours under the above conditions the efficiency of the lamps would be low, for each lamp would require a current of 78 watts.

Cost of Operating Arc Street Lighting System.

As per your offer to subscribers of MUNICIPAL ENGINEERING, we want to ask that you send us what information you have regarding the cost of operating street arc lighting system in towns of thirty to fifty thousand population, having, say, two hundred lamps; forty of these lamps to operate on all-night schedule and one hundred and sixty on moon-light.

We are especially anxious to obtain data on the cost of arc lamp carbons, inner and outer globes and lamp repairs per annum.

The writer has always used forty-five dollars as rough figures to take care of all cost of operation from a 6.6 ampere series alternating current arc lamp, but we would like to know what it has cost other plants. G., ————, Tenn.

The best analysis of all the costs of a gas, electric light and street railway system, carefully separated and classified so that every item stands clearly by itself for a city of slightly less than the size named will be found in the decision made March 8, 1910, by the Railroad Commission of Wisconsin in the case of the State Journal Printing Co., et al., vs. Madison Gas and Electric Co.

The cost of such items as globes, carbons, etc., is not given, but the fixed cost of supplying light and the cost of current is carefully separated. The fixed cost includes cost of maintenance, repairs, supplies, interest, dividend and sinking fund or depreciation charges and amounts to $22.49 per lamp per year for the 271 arc lamps used in lighting the streets of Madison. The 216 lamps operating until midnight required 835 kilowatt hours of current each per year, the cost of which was $28.82 a year, making a total cost per lamp per year on midnight schedule of $51.31. The fifty-five lamps run all night required 1,558 k. w. hrs., costing $53.78 per year, making the cost of an all-night lamp, $76.27 a year.

An article in MUNICIPAL ENGINEERING, vol. xxxviii, p. 249, gives some figures of cost of labor and materials per lamp for trimming various kinds of lamps used for street lighting and also an estimate of the cost per lamp for repairs.

Other articles in the current volume, containing more or less information on the specific question asked and on matters related thereto, some of which give references to previous articles, will be found on pp. 44, 107, 166, 169, 186, 187, 330.

Exchange of Telephone Service Between Rival Companies.

Can you give me the names of any cities of 30,000 or more population having more than one telephone system or company, that is, the Bell and an independent company, and any of such requiring an interchange of business so that subscribers of one company can talk with subscribers of another company?

J. DAVID REED,
Mayor, Porttsmouth, Va.

The writer knows of no such exchange of services in cities of the size mentioned. There is such exchange in some very small towns and villages. Can our readers cite any cases of such exchange in either large or small places?

Excessive Rates for Water and Electric Light.

I enclose you a copy of the franchises which the present city government found existing, when it took charge of the city affairs. I would appreciate it if you could compare our water rates and electric-light rates with those paid by other cities of about our population, 5,000. Our citizens believe they are paying too much for both. Our water is pumped from the Missouri River into reservoirs to an elevation of 185 feet and from there is distributed by gravity throughout the city. Our citizens believe the water rates very excessive, and we would like light on the subject if you can give it to us.

E. A. WILLIAMS,
Pres. Board City Commissioners,
Bismarck, N. D.

The water rates given in the latest franchise state that the company "shall not charge the said city for water for sprinkling streets and flushing sewers a sum to exceed 12 cents per 1,000 gallons; provided, that all sewers covered by this provision shall have a fall of at least 6 inches to each 100 feet; and no charge shall be made for water for the use of the fire department for fire purposes except the annual amount or sum herein specified for the use of each of the fire plugs or hydrants hereinafter mentioned; and said company shall not charge any of the inhabitants of said city, or any person, company or corporation engaged in selling water from wagons, to exceed

7 cents per barrel of 40 gallons; and shall not charge to exceed 40 cents per 1,000 gallons for the water furnished to any person, firm or corporation using said water solely for the purpose of irrigating lawns and gardens, or for the production of hydraulic power, or for running motors." Another section fixes the hydrant rental at $75 per hydrant per year for the term of the contract, to May 26, 1926.

The latest electric light franchise provides that the company "shall not charge the city of Bismarck for electric lights for city purposes at a rate to exceed 33 1-3 cents per night each for 1,200-c. p. arc lights; provided that the said city shall take at least 10 such lights if any be ordered; nor a rate to exceed $2 a month each for 16-c. p. incandescent lights; and the prices to be charged the inhabitants of said city shall not exceed the rate of 1 cent per hour on each 16-c. p. incandescent light; nor at a rate greater than 6 cents per hour each for 1,200-c. p. arc lights." Another section provides that all-night service may be required for city lights. This franchise runs 30 years from May 18, 1905. A later ordinance fixes the price for 16-c. p. gas at $4.50 per 1,000 cubic feet, with four free burners during council meetings.

An earlier ordinance gave a 25-year franchise from Aug. 10, 1900, at not to exceed 20 cents per 1,000 watts and contained the provision that three arbitrators should be chosen on notification by the city council, who should hear "proofs and allegations of parties" and "fix a price by report in writing" to be paid by the city for electric light during the period, not less than one year, submitted to the arbitrators for adjustment. This provision does not seem to have applied to rates for private service.

The private water rate of 7 cents for 40 gallons is evidently $1.75 per 1,000 gallons, for water for household purposes, as compared with 40 cents for water for irrigation purposes and 12 cents for water for sewer flushing purposes. It is difficult to see the effect of the gradient of a sewer on the price per 1,000 gallons of water for flushing it. In the most complete table of water rates published, found in the "Manual of American Water Works" ($5), there is one small place charging $1.60, asother charging $1.50, 7 others charge $1, 3 others 75 cents, 3 others 70 cents, and less than 5 per cent. charge more than 50 cents per 1,000 gallons maximum. While no definite opinion can be expressed regarding the correctness of a given rate without full knowledge of the expense of supplying the water, a rate so much higher than those in other cities is presumably excessive, especially since there seems to be no difference in the water supplied for domstic irrigation and sewer flushing purposes. The $75 rate for hydrants is not so excessive, but it is about 30 per cent. in excess of the average small towns.

The rate for arc lights equals about $121 per lamp per year, and that for 16-c. p. incandescents $24. These rates are something like 30 to 35 per cent. higher than the average, but cost of fuel or labor or freight may justify the excess. This can be determined only by a careful study of the subject on the ground.

The rate for private lighting is so peculiar that a statement of the way in which it is applied in practice would be necessary before any judgment regarding its fairness could be made.

The modern tendency is to regulate rates with reference to the necessities of each case, after careful expert study of the actual facts. The decisions of the Wisconsin Railroad Commission show the scientific method of attacking the problem. The article in the May number of MUNICIPAL ENGINEERING, vol. xxxviii, p. 335, on "Co-operative Franchises for Municipal Public Service Corporations," and the articles to which it refers give methods of applying the same principles in cities in states not having such state public service commissions.

Profile of Gas Pipe Line.

I would like a little information regarding the resistance of gas going through a pipe. The line being in a mountainous country, if a deep valley can be avoided, say 300 feet depth, would it be policy to go around such a valley by lengthening the pipe, say 100 or possibly 200 feet? Of course, there are places it cannot be done, but when it can be done on a line 40 miles or more long, I think it would be well to go on as uniform a grade as well as line as possible.

D., Kane, Pa.

There have been but few scientific observations on the flow of gas in pipes and the effect of undulations in the gradient of a long gas pipe line is not very definitely known. Gas being lighter than air, it is of course an advantage, for it to flow up hill, and every dip in the grade line means additional power expended in pumping. It is certainly better to follow a uniform gradient whenever it is possible.

Can any of our readers give results of observations or references to records of such results?

Pressure of Water in Pipes.

What would be the pressure in a water main 4 to 10 inches large from a tower tank of 150,000 to 200,000 gallons capacity, height 80 to 100 feet?

CITY CLERK, ———, Kan.

The data are not sufficient to answer this question exactly. If the water is standing still in the system, the pressure at any point will depend on the elevation of the surface of the water in the tank above the point in the pipe at which the

pressure in desired. If the tank is 100 feet high and is full of water, and the point in the pipe at which the pressure is desired is at the same elevation as the bottom of the tank the pressure will be about 43 pounds. If the difference of elevation is more or less than 100 feet the pressure will be more or less in the same proportion.

If water is flowing in the pipe the pressure will be reduced by the friction and other resistances to flow, and the amount of this reduction will depend mainly on the size of the pipe, the velocity of flow of the water, and the distance it flows in the pipe from the tank to the point where the pressure is measured. This loss of pressure should be small and will be in a well designed system, but it is sometimes excessive in water works systems not designed by experts.

Materials for Mosaic Floors.

I would like to get some information regarding mosaic floors, as to where I can buy mosaic crushed per ton in different colors, also half-inch tile and emery stone to rub or polish with. The mosaic I would like to get varies in size about the size of a pea. It is placed on concrete and then rubbed down with emery stone, and half-inch tile is placed in expansion joints.

M., Mt. Clemens, Mich.

There are many dealers in such mosaic materials. Those nearest the location named are American Mosaic Co., 97 Shelby street, Detroit, Mich., ceramic and marble mosaics; E. A. Bressler Co., 26 Lafayette ave., Detroit, Mich., ceramic; Venetian Marble Mosaic Art Co., 98 Brush st., Detroit, Mich., marble; John Caretti & Co., 172 Michigan ave., Davis, Marble Co., 302 Michigan ave., Hawes & Dodd, 24 Adams st., Chas. F. Lorenzen & Co., 278 N. Ashland ave., Weary & Beck, 164 Dearborn st., Daprato Statuary Co., 173 W. Adams st., Davidson Bros. Marble Co., foot of Orleans st., M. Keating & Sons Co., 224 Washington st., Wm. H. Jackson Co., 163 Michigan ave., Chester N. Marthens Co., 701 W. 53d st., Sherman-Flavin Marble Co., 2519 State st., all in Chicago, Ill.; J. C. Iversen, 425 E. Water st., Milwaukee, Wis.; Lautz Co., 861 Main st., Mosaic Marble and Enamel Co., foot Hudson st., Buffalo, N. Y.; Norcross Co., 1264 Riverbed, Vincent-Barstow Co., 725 Euclid ave., Chester J. Wadsworth, 5806 Euclid ave., Cleveland, O.

Information About Water Rates.

I am very desirous of securing a report covering the water rates of the various cities in the United States, and would be glad to have you send me at once, at our expense any publications, books or pamphlets which you may have on the subject.

I understand that a report was published in 1907, the same being a paper read at the twenty-eighth annual convention of the American Water Works Association in 1907, by Dow R. Gwin, the same being entitled "Water Rates Charged in 375 Cities." If you haven't a copy of this pamphlet, I would be glad if you will give me Mr. Gwin's address so that I may write him direct.

R., Macon, Ga.

The largest collection of water rates is that in the "Manual of American Water Works" for 1897 ($5), although the rates are somewhat condensed on account of the limitations of space. Copies of Mr. Gwin's paper may possibly be obtained by addressing him at the water works office, Terre Haute, Ind., and copies of the annual volume of proceedings of the association containing the paper can be obtained of the secretary, J. M. Diven, of the Water Works Company at Charleston, S. C., and will probably cost one dollar.

Comparisons of water rates in other cities are of little real value in determining the rates in a given city. Conditions vary so much and cost of operating varies so much that the new rates should be determined after a thorough study of the income and expenses of the plant and of the probable effect of any changes in the rates. The methods employed by the Wisconsin Railroad Commission in revising rates are the most scientific and give the most satisfactory practical results.

Makers of Concrete Block Machines.

Will you please inform me where I can buy cement block machine for making hollow moisture proof blocks as illustrated on page 159, Brown's "Hand Book for Cement Users," issued by you, dated 1905, and oblige. C. M. M., Murdo, S. D.

Such machines can be obtained of the Ashland Steel Range and Manufacturing Co., Ashland, O., the Fisher Hydraulic Stone and Machinery Co., Baltimore, Md., the Waterloo Cement Machinery Corporation, Waterloo, Iowa; the American Cement Machinery Co., St. Louis, Mo.; A. F. George Co., Los Angeles, Cal., and others. Reference may be made to the "Business Directory" printed in each number of MUNICIPAL ENGINEERING, under the headings "Cement Block Machines," "Cement Brick Machines," "Concrete Blocks," "Concrete Construction Machinery."

The makers mentioned make blocks by different processes, but can all give instructions for making waterproof blocks by their methods.

Articles on Concrete Paving.

Has there appeared in any recent number of MUNICIPAL ENGINEERING a comprehensive article on concrete paving? I am looking for such information as to cost, specifications and efficiency.

M. E. C., ————, Minn.

The following articles have appeared in the last few volumes of MUNICIPAL ENGINEERING:

In vol. xxxviii: "Specifications for concrete sidewalks, curbs and gutters and pavements," p. 244.

In vol. xxxvii: "Will a Concrete Street Crack?" p. 35; "Cost of Street Paving," p. 177. The article on p. 35 refers to a number of prior articles describing various forms of concrete paving, such as the Blome, in vol. xxxv, p. 369, and vol. xxxiv, p. 412; a German pavement in vol. xxxv, p. 36; Richmond pavements in vol. xxviii, p. 388, and vol. xxxiv, p. 168; the Toronto pavements in vol. xxvii, p. 350; the Grand Rapids pavements in vol. xxiii, p. 400; the Bellefontaine pavements, now about 20 years old, in vol. iv, p. 229, vol. xvii, pp. 383, 384, vol. xix, p. 427, vol. xxxv, p. 180, and others.

Cast Stone Boat Ends.

For sometime I have looked for information or advertisement in regard to cast stone boat crooks or ends. If you will inform me I will write for description and price. Would like one that can be used with a pole.

W. H. T., Rhinebeck, N. Y.

Can any of our readers answer this inquiry?

Forms for Concrete Sewers—Books on Reinforced Concrete Sewers.

I desire to obtain the names of manufacturers of forms for concrete sewer work. Also names of books which give most information on design and construction of reinforced concrete sewers. Such information as you may be able to give me will be greatly appreciated.

E. R. W., Port Huron, Mich.

On page 368 of the May number will be found a list of patents which contains several on molds for concrete sewers and pipes. The American Cement Machinery Co., St. Louis, Mo., can supply the desired forms. Other makers of such forms are the Adjustable Steel Centering Co., Fond du Lac, Wis.; Blaw Collapsible Steel Centering Co., Pittsburg, Pa.; Merillat Culvert Core Co., Winfield, Iowa; Ray Thomas, Faribault, Minn.

More or less information about the construction of reinforced concrete sewers will be found in Taylor & Thompson's "Concrete, Plain and Reinforced" ($5), and Buel and Hill's "Reinforced Concrete" ($5).

Sanitary Provisions Without Water or Sewers.

Our Board of Health is desirous of obtaining information as to the best method of outdoor closet to adopt as a regulation closet for use in those parts of our city where sewer and water connection can not be obtained.

Outside our water and sewer area and in many of the older class of houses within, we have up to the present had in use closets equipped with a sanitary pail. This we have found to be an expensive method as these pails have to be emptied both winter and summer, once per week. In winter a thawing process is necessary as a preliminary and in summer the odor from these pails is very insistent; moreover we have reason to believe that the flies feed on the contents of these pails and convey typhoid poison to food supplies in houses, thus explaining the large number of cases we have usually in September and October each year.

I am of opinion that pits of a regulation depth suitable for cleaning, with a regulation closet, would be less objectionable, less expensive and more sanitary than the pail or box system, provided wells are prohibited. Our soil here is a heavy clay somewhat impervious to moisture. City water is obtainable from the water wagons by those who cannot get water service at present.

I would be glad to have any information you can give me as to the method you have found best in your city, and also your opinion of the comparative merits and defects of the pail or box system and the pit system.

T. H. WHITELAND,
Medical Health Officer,
Edmonton, Alberta.

Any provision for taking care of house wastes other than immediate removal by water carriage requires the most rigid and constant supervision by the health authorities, but it is possible to inaugurate a comparatively inexpensive system and to operate it without nuisance, the great expense being in the payment of the force of inspectors.

It is possible to operate earth closets inside the house without odor or danger from flies in both summer and winter, but they must be used only for human excrement and there must be a sufficient supply of dry absorbent earth or fine ash, or a mixture, so that every solid or liquid deposit shall be completely covered and absorbed as soon as made. The use of such closets can be learned as readily as the use of water closets, but the average citizen, not to speak of the children, is too careless to perform the covering process completely and carefully. This accounts for the freezing of the contents of pails in the winter and consequent difficulty of removal if they are used in a cold outbuilding, for natural carelessness about such use is emphasized by the desire to get in out of the cold. Between the possibility of odors due to carelessness in the use of the earth closets in the house and the almost certain difficulties of removal in the winter if they are located in outbuildings, the authorities much choose according to their local conditions.

Perhaps the removal problem would be somewhat simplified if the full pails or boxes were carried to the place of disposal for emptying, a clean pail being left in place of each full pail removed from a residence. If necessary there might be a provision for placing the pails in a heated room for thawing out, and there should be a provision for thorough cleaning and disinfection before the pails are again used.

The matter of earth closets and also that of vaults or pits is briefly but comprehensively treated in Chapins' "Municipal Sanitation in the United States" ($5), a most valuable book for the health departments of cities.

In the January number of MUNICIPAL

ENGINEERING, vol. xxxviii, p. 37, will be found a collection of regulations governing the cleaning of vaults or pits and regulations of their size, much of the information being taken from Dr. Chapin's book.

As to which method produces the least nuisance and can be operated with the least trouble and expense, no definite answer can be given. It depends upon the habits and customs of the people. If they have been brought up to the use of the earth closet there will be little or no difficulty in operating that system. If they have been accustomed to the pit or cesspool system it will be difficult to teach them the necessity of careful operation of the earth closets. The pits are almost certain to become nuisances unless cleaned and thorough disinfected at reasonably frequent intervals. They will have the advantage in a cold climate that it will not be necessary to clean them during the winter, but it is difficult to disinfect or deodorize them without cleaning them, especially if any water except human excrement drains into the pit. The writer is disposed to favor for a city in the latitude of Edmonton, the pits if deep enough, made of concrete, water tight, with no overflow, and protected from the entrance of any water. If cleaning is delayed they can be deodorized when necessary by comparatively small doses of chemicals dissolved in water and careful deposit of dry absorbent fine earth and ashes.

If a residence has water supply, but no sewer, the Ashley residential septic tank, described in MUNICIPAL ENGINEERING, vol. xxiii, p. 35, or those described in vol. xxiii, p. 37 and in vol. xxxv, p. 244, may be found available.

Book on Sewer Pipe Manufacture.

Will you very kindly advise where the writer can secure a book on the manufacture of vitrified sewer pipe?

I. M., Kansas City, Mo.

The writer knows of no book on the manufacture of vitrified sewer pipe, and of but one, Hanson's, on the manufacture of cement tile and pipe. Can our readers give any information on the subject?

How to Pay for Sewer System.

The city of Phoenix is contemplating at the present time the installation of a sewer system costing in the neighborhood of $400,000, and no little argument is being used as to the best means of raising the money for this particular purpose.

If I could trespass on your time I would appreciate it very much if you would furnish me with such information as you may have as to the most advanced means adopted at the present time by municipalities for raising the funds necessary to install sewer systems.

The argument here is against a straight bonding proposition and for the assessment plan. Some few of us have pronounced ideas as to which is the better method, but they are apparently not convincing, and I should like some information from an authentic source as to the methods employed.

H. S. R., Phoenix, Ariz.

This question should be answered for the city of Phoenix by some one familiar with the laws of Arizona.

Theoretically there are three principal elements in the assessment of the cost of sewers which should be considered in every case. Practically all but one or two of them, not always the same, are neglected.

If the whole sewer system is constructed at once, it may very well be paid for by the city at large, the money being raised by bonds or directly by tax. But a strict application of the principles referred to would cause the assessments of benefits to be distributed in a manner somewhat like that stated below.

If parts of the sewer system are constructed at different times, the following points should be considered:

1. The sewer system is of benefit for drainage largely in proportion to area and this portion of the cost should be assessed according to area.

2. It adds to the value of a lot in proportion to the value of the lot, if it is assumed that every lot requires a connection for sanitary purposes. This statement may be modified somewhat in the case of lots used for some particular purposes, such as storage warehouses, coal yards, etc., which require but little in the way of sanitary service.

3. The city as a whole is benefited by drainage and general sanitary improvement and should pay its share of the cost, say for drainage in proportion to area of public streets, grounds, buildings, etc., and for sanitary purposes according to the best judgment of the assessing authority.

4. A main sewer benefits the whole district which will ultimately drain into it, and the cost of such sewers in excess of those for the purposes of the abutting property should be distributed over the whole drainage district in accordance with the preceding principles. A local sewer may be assessed directly upon the abutting property benefited, including the city for the common areas.

The subject is discussed in considerable detail in a number of articles which have appeared in MUNICIPAL ENGINEERING, the latest of which, in the March number, vol. xxxviii, p. 190, contains references to the others.

Catchbasins on Unpaved Streets.

Renville is a town of about 1,500 inhabitants, and is putting in a drainage system for storm water, cellars, low ground surface water, etc. In the principal streets would you recommend a simple form of catch basin for storm water inlet or would you recommend a street inlet running direct to the drain? The streets are not paved. Would there be danger of silt being deposited and

clogging the drains, the grades varying from 0.10 to 0.20 per cent.

C. W. J., Renville, Minn.

Presumably the drains will be of vitrified pipe, the circumstances not requiring them to be so large that brick or concrete must be used. In such case the lowest gradient named, which is equivalent to a fall of 1 foot in 1,000. would hardly be strong enough to insure that the sewers would be self cleansing, with large quantities of silt washed in from the unpaved streets.

Catch-basins are of no value unless the deposits in them are cleaned out before the basins are filled up to the level of the outlets. The question is therefore one of comparison of the cost of cleaning catchbasins whenever test shows cleaning to be necessary and cleaning sewers at regular intervals so that there will be a certainty that they will not be stopped up. Probably the catchbasin cleaning will be the cheapest with unpaved streets, especially if the streets are not hard macadam streets, but are subject to wash by the general passage of heavy rainfall over the surface or of large quantities flowing rapidly in the side ditches or gutters.

If it were possible to give the drains more fall and the streets were paved, and no sewage entered the drains the case might easily be reversed.

Books on Macadam Roads.

Is there any book published which is considered an authority on macadam streets and roads?

"Kidder" and "Trautwine" are authorities in their line, and if there is such a book covering road building, particularly crushed stone construction, we would like to get it. V., ———, Ind.

An excellent book covering all parts of the standard macadam road, not treated with oil or tar, is Byrne's "Highway Construction" ($5); Aitken's "Road Making and Maintenance," is an English book which is also standard. Books treating of methods of improving the quality of macadam roads, all new, are Hubbard's "Dust Preventives and Road Binders" ($3); Smith's "Dustless Roads, Tar Macadam" (English, $3.50); Judson's "Road Preservation and Dust Prevention" ($1.50).

Where Has Gilsonite Been Used in Asphalt Pavements?

Con you give me any information through the question department of your magazine as to where, in what cities (first class) there has been any Gilsonite asphalt material laid and with what success.

J. B., Milwaukee, Wis.

Gilsonite is reported to have been used in asphalt pavements at some time during the last fifteen years in the following cities: Chicago, Ill.; Waterloo, Des Moines, Mason City, Iowa; Oklahoma City, Guthrie, Sapulpa, Muskogee, Shawnee, Okla.; Denver, Col.; St. Louis, Kansas City, Mo.; Ft. Wayne, Ind.; Memphis, Tenn.; Montgomery, Huntsville, Ala.; Wichita, Kan. The writer has not knowingly seen any of these pavements except those at Ft. Wayne, which are about eighteen months old, having passed through two winters. They promise to require very slight expenditure for repairs during their ten-year period of guaranty. Such reports concerning the others as have reached the writer indicate that they are equally satisfactory.

Can any of our readers give the results of their observations of Gilsonite asphalt pavements, giving detail of date and method of construction and present condition?

As shown by the report in MUNICIPAL ENGINEERING, vol. xxxvii, p. 255, the amount of Gilsonite produced has increase from about 11,000 tons in 1905 to about 19,000 tons in 1908. Some of this increase has been on account of increased use in pavements, although Gilsonite is extensively used also in the manufacture of paints, varnishes and other products requiring a very pure asphalt.

Garbage Disposal in America.

Nous vous serions tres obliges si vous pouvez nous documentes sur les resultats obtenus en votre pays par les procedes de cuisson des ordures menageres ongadues des villes pour la production de la vapeur ou des engrais. Ou a-t-on fait des applications de ce systeme et a qui pouvons nous nous addresser pour obtenir des resseignements detailles a ce sujet.

BAUDY,
Chaumont, Haute Marne, France.

Morse's book on "The Collection and Disposal of Municipal Waste" ($5) gives descriptions of practically all the garbage disposal plants in the United States. His article in MUNICIPAL ENGINEERING, vol. xxxviii, p. 258, describes the systems of destruction of garbage, including the production of steam. The series of articles by Hugh S. Watson, in vol. xxxvii, p. 287, vol. xxxviii, pp. 1, 73, 143, 229, 299, etc., while written by an Englishman, well describes American practice in garbage destruction at high temperatures, for practically the same furnaces are used in both countries. Other articles describing less satisfactory methods of garbage disposal will be found in vol. xxxvi, p. 36, and vol. xxxv, pp. 179, 359 and 376, and others in still earlier volumes.

Information About Public Markets.

I write to ask that you refer me to any copy or copies of MUNICIPAL ENGINEERING that deals with the subject of city markets, their dimensions, general plan and method of operation. If this subject has not been covered by your journal, I will appreciate your giving me any information that will lead to my getting up-to-date literature on this matter.

L. E., Little Rock, Ark.

Only recently have any approximately thorough studies been made of the prob-

lems of the public market and, so far as the writer knows, none of these have found their way into book form. The proportion of stand-space to passageways, the volume of air in the room, the supply of heated or cooled air of proper humidity, the separation into departments for different kinds of marketable products so that each department will have its supply of proper volume and quality, the control of the air supply so that the variations in number of people can be provided for, the extraction of odors and prevention of their spread out of their departments, the supply of day-light without direct sunlight during market hours and of direct sunlight during vacant hours for purifying purposes, the provision of closed cases, humidors and refrigeration for the products requiring these various treatments, the provision of thorough drainage, and arrangement of stands so that thorough washing with plenty of water under pressure is easy, the provision of convenient methods of collecting and removing the solid refuse, the provision of cold storage and dry storage, and a number of lesser, related problems should all be considered in the design, construction and operation of a market. But few architects or engineers have made these studies. The writer knows but one or two.

Some of these matters have received a reasonable amount of attention in a market recently constructed by a private company in Seattle, Wash., some description of which will be found in an article in the department "From Workers in the Field."

FROM WORKERS IN THE FIELD

Practical Points from Practical People.

Contributions to this Department are invited. Give from your experience for the benefit of others. No matter about the style of the composition, the fact is what is wanted. Use the Question Department for what you want to know; use this Department for what you can tell others.

Experts in California Asphalt.

The undersigned notes in the Question Department, MUNICIPAL ENGINEERING, April number, an inquiry regarding asphalt paving experts who have had some experience with California asphalts. As I am always willing to give any one interested the benefit of my experience in the asphalt paving industry, it may not be amiss for me to advise the gentleman making inquiry that I have been continuously engaged in the asphalt paving industry since 1883. Until five years ago I was connected with companies using so-called "natural" asphalts exclusively.

About that time I became interested in the asphalts manufactured from the heavy malthas obtained on the Pacific coast, and after careful and exhaustive examination I was led to conclude that asphalts properly produced from that source were far superior to most of the so-called "natural" asphalts. I have since been interested entirely in the California productions and will be pleased to give anyone interested the benefit of my experience in that line, as it has been undoubtedly proven that pavements laid from California asphalt which has been properly refined and is properly used at the paving plant is a very superior pavement.

In 1903 220,416 tons of so-called "natural" asphalt was imported to the United States, while only about 32,000 tons of California material was marketed. The year 1907 shows that about 65,000 tons of so-called "natural" asphalt was imported in the United States, whereas 110,000 tons of California were produced and sold. There must be a reason for these figures, which are approximately very correct.

GEO. W. LAMSON,
Chicago, Ill.

Form for Water Bill.

The face of the bill for water used by the water commission of Frankfort, N.Y., is shown in the accompanying cut, also of the stub. A notable point is the method of securing advance payment on a bill for metered water. The bill is for six months and the minimum bill is $7 a year or $3.50 for six months. For the first six months of the contract, or proportionate time to October 1, the consumer pays in advance the half or proportionate amount of $7. Thereafter he pays in advance half of the bill for the preceding year, so that, while he is paying in advance for

water he is actually paying the amount which accrued from his use of water during the preceding year. This is shown in the fine print on the face of the bill. Following are the items of information given on the back of the bill:

RULES AND RATES.

I. All bills are made to the owner of the premises and are due when presented.

II. Meters must be easy of access at all times for examination by the water commissioners.

III. They must be protected from freezing or other injury by the care and at the cost of the water consumer.

IV. Meters must not be tampered with and must not be removed without notice to the water commissioners.

V. If a meter gets out of order and fails to register, the consumer will be charged at the average daily consumption of water as shown by the meter when in order.

VI. All water passing through the meter will be charged for whether used or wasted.

VII. No meter rate less than $7. One cubic foot of water is seven and one-half gallons.

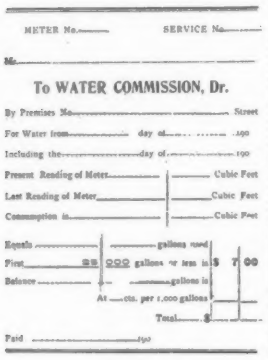
VIII. Every consumer of water should learn to read his meter and observe that there is no waste of water by leakage. Meters will not register more water than passes through them. To test a meter, close all fixtures and watch the hand on the dial registering the smallest number of cubic feet. If the hand moves at all, there is a leak—find it and have it stopped. Its further accuracy can be tested by the consumer at any time by noticing whether the meter registers one cubic foot when seven and one-half gallons or sixty-two and one-half pounds of water is drawn from the pipe.

VILLAGE ORDINANCES.

Chapter XII. Sec. 1. Water Rents.—All water rents may be paid semi-annually in advance at the First National Bank of Frankfort, New York, on or before the first day of April and October of each year, and five per cent will be added to and collected on all water bills remaining unpaid 20 days after the water rents shall actually be due and unpaid; and should any water rents remain unpaid for a space of 30 days after the same is due and notice personally served upon the party or person owning the premises to which the water is supplied, or on the agent thereof that said water rent is due and unpaid, the supply of water to said premises shall be shut off.

STATE LAWS.

Sec. 227. Connections with Mains.—Supply pipes connecting with mains and used by private owners or occupants shall be laid and kept in repair at their expense. Such pipes can only be connected with the mains by permission and under the direction of the Board of Water Commissioners. A member of the board or its authorized agent may at any time enter a building or upon premises where water is used from supply pipes and make necessary examinations.


METER No.——— SERVICE No.———

Mr.———

To WATER COMMISSION, Dr.

By Premises No.——— Street

For Water from——— day of——— 190

Including the——— day of——— 190

Present Reading of Meter——— Cubic Feet

Last Reading of Meter——— Cubic Feet

Consumption in——— Cubic Feet

Equals ——— gallons used

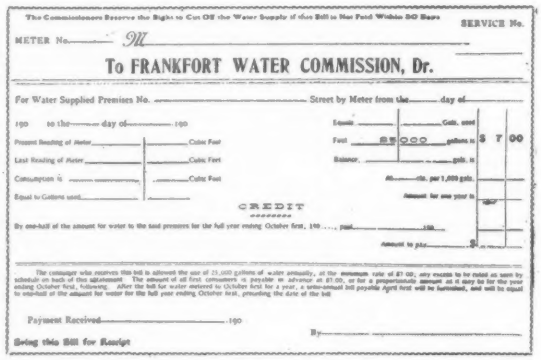
First 25 000 gallons or less in $ 7 00

Balance ——— gallons in

At ——cts. per 1,000 gallons

Total $———

Paid ——— 190


The Commissioners Reserve the Right to Cut Off the Water Supply if this Bill is Not Paid Within 30 Days

METER No. M SERVICE No.———

To FRANKFORT WATER COMMISSION, Dr.

For Water Supplied Premises No. ——— Street by Meter from the——— day of———

190 to the——— day of——— 190

Present Reading of Meter——— Cubic Feet

Last Reading of Meter——— Cubic Feet

Consumption in ——— Cubic Feet

Equal to Gallons used———

Equals ——— Gals. used

First 25 000 gallons at $ 7 00

Balance ——— gals. at

At ——cts. per 1,000 gals.

Amount for one year is

CREDIT

By one-half of the amount for water to the land premises for the full year ending October first, 190 ..., paid——— 190

Amount to pay $———

The consumer who receives this bill is allowed the use of 25,000 gallons of water annually, at the minimum rate of $7 00, any excess to be rated as seen by schedule on back of this statement. The amount of all first consumers is payable in advance at $7.00, or for a proportionate amount as it may be for the year ending October first, following. After the bill for water entered to October first for a year, a semi-annual bill payable April first will be furnished, and will be equal to one-half of the amount for water for the full year ending October first, preceding the date of the bill

Payment Received——— 190

By———

Bring this Bill for Receipt

25,000 gallons or less, per year, lump price yearly, equal to 28 cents per 1,000 gallons, is the sum of $7.00.

1. 35,000 gal. or less, per year, each 1,000 gals., 24 cts. after first 25,000 gals. is $7.24—$9.40.
2. 50,000, 21 cts., $9.40—$12.25.
3. 65,000, 18 cts., $12.25—$14.20.
4. 85,000, 15 cts., $14.20—$16.00.
5. 105,000, 13 cts., $16.00—$17.40.
6. 225,000, 12 cts., $17.40—$31.00.
7. 500,000, 11 cts., $31.00—$59.25.
8. 1,000,000, 10 cts., $59.25—$104.50.
9. 1,700,000, 9 cts., $104.50—$157.75.
10. 2,600,000, 8 cts., $157.75—$213.00.
11. 3,500,000, 7 cts., $213.00—$250.25.
12. 5,000,000, 6 cts., $250.25—$305.50.
13. 8,000,000, 5 cts., $305.50—$405.75.

All greater quantities at the rate of 5 cents per 1,000 gallons.

A bill for 35,000 gallons used in a year would be computed thus:

35,000 gal. meter reading.
25,000 gal. at.....$7.00
10,000 gal. at 24c..... 2.40
Total $9.40

After the first year half of this amount could be paid in April and the other half in October, as shown on the face of the bill.

Day Labor vs. Contract Work on Los Angeles Aqueduct.

The following interesting communication appeared in a recent number of *Pacific Outlook*, published at Los Angeles, Cal.:

In your issue of December 11, 1909, you publish a copy of an article which appeared in "Engineering-Contracting," reviewing a report by Metcalf and Eddy, consulting engineers of Boston,—this report having been made to the Boston Finance Commission on the relative economy of doing public work by contract or by municipal day labor, called "force account." The finding is that force account work is the more expensive method in certain New England cities.

The entire tenor of the article is to the effect that all public work should be done by contract. The report by Metcalf and Eddy has been extensively reviewed by engineering publications. The firm of Metcalf and Eddy are engineers in good standing, but it should be remembered that "Engineering-Contracting" is a paper that is devoted to the interests of the contractors of the United States.

Much municipal work has been done in the past without adequate supervision and economic management, men of low efficiency often gradually accumulating in a permanent organization. When public work is performed politically, there is no limit to the extravagant costs that may result, just as there would be under contract work resulting from collusion, and a discussion thereof is superfluous. The question, therefore, resolves itself into one of whether municipal work can be organized on business principles. There is no reason why a municipality with large financial resources, capable of buying adequate equipment and paying reasonable salaries, should not obtain as high grade machinery and superintendents as any contractor. Manufacturers take pride in selling their equipment to a municipality or to the Federal Government, and advertise such sales extensively. Most young men, and particularly ambitious young engineers seeking experience and reputation, desire connection with large public organizations in an official capacity, provided the job is clean, and they are usually willing to work at less wages than they would for an individual.

Let no one think that the engineering direction of public work under contract is a flowery bed of ease. It requires as much detailed supervision and vigilance as if the work were carried on by an organization reporting directly to the engineer. Often when contractors encounter great difficulties and unexpected expenses, the municipality and the engineer are left to finish the work. This was illustrated in the case of the outfall sewer in Los Angeles and at the Laguna Dam which was started for the Reclamation Service by one of the largest contracting firms in the United States. Conversely, if the work proves unexpectedly easy, the municipality would not share in the resulting good fortune. It is often a case of "heads I win and tails you lose."

There is more temptation for a contractor, no matter how honorable he may be, to skimp his work for which he is paid a fixed sum, than for a municipality to slight its own work under the force account system. Pieces of work on which the costs are very uncertain, such as tunnel driving and foundation work, are those best suited to the force account system, because a good contractor must assume all unfavorable conditions as occurring, and bid accordingly.

When public work is let by contract, it must be as the result of advertising and the law usually compels the award to the lowest bidder or to the lowest responsible bidder. In our own street work, it must be the lowest bidder or all bids must be rejected. The lowest bidder may be a bidder with bad judgment as to probable costs, and while his bid may be protected by bond, the bond is of little practical value. I have never known of collection on a contractor's bond.

The greatest advantage that the contractor enjoys is that he can purchase materials and employ men quickly, whereas municipal officers are seriously incumbered with formalities, designed to prevent fraud, but which are an expensive handicap to an honest administration.

The Los Angeles Aqueduct is in charge of a non-partisan and most efficient board of public works. About 95 per cent of the work is done by force account. There is not a political appointee in the entire organization. The engineers are energetic young men, ambitious to make reputations and are promoted on merit. The bonus system is applied where possible, and the results so far obtained have been most satisfactory.

The Jawbone Division is twenty-two miles in length and is the heaviest on the Aqueduct. Consequently, it was one of the first to be opened for construction. In order to determine whether this work should be done by contract or by force account, bids were called for; these were compared with the engineers' estimates and finally all bids were rejected and the engineering department ordered to construct the work by force account. Mr. A. C. Hansen was placed in charge as division engineer.

The Jawbone Division is now 80 per cent completed. It is possible, therefore,

to make a comparison between the cost of the work done by the municipality and the prices bid by the contractors. It will be appreciated, however, by any person who has had experience in construction work, that the unknown elements of the cost for "extra work" done by the contractor are most important ones, which do not appear in a bid but which are covered by the force account cost figures which are here presented.

These "cost figures" are reliable; each piece of work is made the subject of detailed study. All charges for general expense, equipment, housing, sanitation, administration, etc., are included. The analysis was made by Mr. O. E. Clemens, in charge of the cost-keeping department of the Aqueduct.

Of the 217 miles of Aqueduct, including three hydro-electric plants and one cement plant, all work is being done by force account with the exception of 11 miles of valley work.

One feature of this work which has been effective in securing good results is the issuing of monthly cost and progress bulletins covering every structure. These show unit costs of similar work at different places, giving credit to those in immediate charge and advertising their results, whether good or bad, throughout the entire organization each month.

COST ANALYSIS.

Five bids were received July 27, 1908, for the construction of the Jawbone Division, as provided in Specification No. 33. These bids, with the exception of the lowest, were submitted by large and experienced contracting firms from various parts of the United States. The unit prices of the low bidder are shown under the tables of costs.

As stated elsewhere, the estimated quantities shown on the original specifications have been somewhat modified to meet conditions developed during construction, the tunnel footage having been materially increased and conduit footage decreased. The comparisons of costs have been based on the quantities as now established. The estimated cost of engineering, in case the work had been let by contract, has been added to the contractor's bid. This expense under the force account system has also been included in the costs shown.

The following plant, according to Specification No. 33, was to be installed or built by the city, for the free use of the contractor. The cost of this has been eliminated from this analysis:

Compressor plants.
Main water pipe lines.
Roads and trails.
Power lines and transformer stations.
Main telephone lines.

The charges for electric energy which would have been made to the contractor have been included in force account costs. The comparison of costs is made on tunnel and conduit work, the cost of culverts being disregarded, as they represent a very small percentage, and have averaged less than the bid.

TOTAL QUANTITIES IN LINEAL FEET.

Section.	Tunnel.	Conduit.	Total.
1	19,636	23,809	43,445
2	21,332	5,326	26,658
3	22,830	10,088	32,918
All	63,798	39,223	103,021

CONTRACTOR'S BID.

Completed and Lined Tunnels.

Section.	Feet.	Rate Per Ft.	Total.
1	19,636	$22.50	$441,800.00
2	21,332	36.70	782,884.40
3	22,830	33.30	760,239.00
All	63,798	Average $31.11	$1,984,923.40

Conduit Excavation.

Section	Feet.	Aver. Yardage.	Price Per C.Y.	Total.
1	23,809	5.9	$1.066	$149,744.32
2	5,326	5.2	1.625	45,004.70
3	10,088	5.0	1.175	59,267.00
All	39,223		Average $6.48*	$254,016.02

Conduit Lining and Cover.

Section.	Feet.	Rate Per Lin. Ft.	Total.
1	23,809	$6.721	$160,020.29
2	5,326	7.00	37,282.00
3	10,088	6.876	69,363.09
All	39,223	Average $6.80	$266,665.38

*Cost per lin. ft.

Under the specifications, cement, tunnel timbers, and reinforcing steel were to be furnished to the contractor free, at the nearest railroad station. This represents a cost to the city as follows:

Cement, per lineal foot of tunnel and conduit	$2.70
Tunnel timbers, per lineal foot of tunnel	.62
Steel, per lineal foot of conduit	.27

In case the work had been let by contract, it would have been necessary to maintain an engineering staff with clerks and inspectors, at the expense of the city, for the period of two and one-half years involved in the contract. This cost would have been $3,715 per month, equal to a total of $111,450, or an average cost per foot of aqueduct of $1.08. The total cost of engineering and supervision, under the force account system adopted, is included in the unit costs given.

ESTIMATED COST OF WORK TO CITY OF LOS ANGELES, IF DONE BY CONTRACT.

Tunnels.

Bid per foot completed	$31.11
Timbers per foot	.62
Cement per foot	2.70
Engineering and inspection	1.08
Total per foot	$35.51

Conduit

Bid—Excavation per foot	$ 6.48
Lining per foot	6.80
Cement per foot	2.70
Steel per foot	.27
Engineering and inspection	1.08
Total per foot	$17.33

Above costs do not allow anything for depreciation on instruments and equipment used by the city on this work.

ACTUAL COST BY FORCE ACCOUNT.

The total amount of work to be done, and footage completed to January 1, 1910, is as follows:

	Total Footage, Feet.	Amount Done, Feet.	Pct Done.
Tunnel excavation	63,798	61,515	96½
Tunnel lining	63,798	33,805	53
Conduit excavation	39,223	33,868	86
Conduit lining	39,223	16,100	41

Detail of Tunnels.

	Total Expended.	Amount Built, Ft.	Unit Cost.
Excavation and timbering	$780,360.00	61,515	$12.70
Lining	229,727.00	33,805	6.80
Total per foot of completed tunnel			$19.50

Detail of Conduit.

	Total Expended.	Amount Built, Ft.	Unit Cost.
Excavation	$121,521.50	33,868	$ 3.60
Lining	117,561.50	16,100	7.30
Total per foot of completed conduit			$10.90

EQUIPMENT, PIPE LINES, ETC., FOR THE ENTIRE FOOTAGE.

Miscellaneous equipment, exclusive of compressor plants, main pipe lines, main telephone lines and roads	$150,000.00
Branch pipe lines, total cost	20,000.00
Local telephone system, total cost	4,000.00
Buildings, including wiring for lights	53,000.00
	$227,000.00

Assuming no salvage on this plant, we have $227,000 divided by 103,021 equals $2.20, average cost per foot for entire division.

MAINTENANCE AND OPERATION TO JAN. 1.

The general maintenance and operation charges on water supply, roads, telephones and division administration, amounts to 3½ per cent of total construction charges, or 68 cents per foot for tunnels and 38 cents per foot for conduit. The charges for the field engineering and supervision are included in the construction costs given.

TOTAL COSTS BY FORCE ACCOUNT.

Tunnels.

Excavation	$12.70
Lining	6.80
Maintenance and operation	.68
Equipment	2.20
Total	$22.38

Conduit.

Excavation	$ 3.60
Lining	7.30
Maintenance and operation	.38
Equipment	2.20
Total	$13.48

COMPARISON.

Tunnels—Cost by contract	$35.51
Tunnels—City costs	22.38
Saving per foot	$13.13
Conduit—Cost by Contract	$17.33
Conduit—City costs	13.48
	$3.85
63,798 feet x $13.13	$837,667.00
39,223 feet x 3.85	151,008.00
Estimated total saving on Jawbone Division	$988,675.00

This estimated saving is conservative, as the work to be completed will cost less per unit than that done previously, owing to the nature of the ground and the im-

provement in the organization. Salvage values of plant, also extra work which we have done and charged to construction (which would have been billed as "extra work" by the contractor) would have a tendency to increase this estimate.

One of the most advantageous features of force account work is the opportunity that it affords to make changes in the location of the line or in the design of the various structures, things which are very difficult to do when a municipality is bound by rigid contract. The economic studies that are made as the work progresses constantly offer suggestions for a change in route or changes in the detail location. The character of the materials which are encountered frequently demands a complete change in the design of a structure to be built. It is thus possible, under force contract with good cost-keeping, to obtain the most economical results and the most stable work.

This change in construction is vividly illustrated by the fact that the first location of our line called for 28 miles of tunnels, whereas the line as it is now being built will contain 43 miles of tunnels.

J. B. LIPPINCOTT.
Chief Engineer Los Angeles Aqueduct.

Cost of Asphalt Repairs in Brooklyn.

To the Editor of MUNICIPAL ENGINEERING:

Sir: Complying with your request I am forwarding you herewith copy of report of the operations of the Municipal Asphalt Plant for the year 1909.

JOHN C. SHERIDAN, Chief Engineer,
Bureau of Highways,
Brooklyn, N. Y.

The report goes into detail of costs of items and classes of items and unit costs. On account of lack of space, the analysis of costs and the summaries only are given in the following extracts from the report:

The Brooklyn Municipal Asphalt Repair Plant is located on the 7th St. Basin of the Gowanus Canal, near 2d Ave. It has a capacity of 270 cubic feet of wearing surface, and 100 cubic feet of binder per hour, and is equipped with self-contained rotary driers, two of which are used for heating sand, and one for binder-stone. The cylinders of these driers are 40 inches in diameter, 19 feet 6 inches long, with longitudinal vanes. Each set is so arranged that they may be driven independently or at the same time. The driers discharge into an elevator, fitted with 10-inch by 6-inch buckets, which convey the material to the respective storage bins above the mixing boxes, whence the material is drawn by gravity into the weighing boxes, which rest on platform scales, so that each batch of material can be accurately weighed. These scales are fitted with double beams, so that the amount of dust used in each batch of wearing surface may also be accurately weighed with the sand. The weighing boxes discharge into the mixers, which have a capacity of 9 cubic feet of wearing surface mixture, and 10½ cubic feet binder. The mixers discharge by gravity into trucks driven directly underneath, and are so arranged as to permit of running out both top and binder simultaneously.

There are three melting tanks of 1,500 gallons each, enclosed, and capable of withstanding 15 pounds pressure, and equipped with mechanical agitators. These tanks are so arranged that any of the three, or all of them, may be used for the asphaltic cement supply to either one or both of the mixers. The asphaltic cement is fed into the weighing buckets by air pressure through standpipes from the bottom of each tank, rising above the level of the mixing floor, so as to properly discharge into the weighing buckets, which run on overhead trolleys, and are equipped with double beam scales.

The power plant has a 60-horse power, water tube boiler, Babcock and Wilcox Co. The plant is driven by a 10-inch by 12-inch automatic cut-off center crank engine, manufactured by the Erie Engine Works, Erie, Pa. Since it is desirable to have the power for agitating the tanks independent from the main engine, so that the tanks may be charged and agitated without running the rest of the plant, there is also a 5-inch by 5-inch vertical automatic cut-off engine, 9-horse power.

Report of Costs and Operation of Municipal Asphalt Plant for the year ending Dec. 31, 1909, and Costs of Maintenance of Asphalt Pavement in the Borough of Brooklyn, New York City:

Plant value Jan. 1, 1909.....	$41,016.10
Betterments during 1909.....	824.82
	$41,840.92

FIXED CHARGES.

Interest on payments on betterments at 5 per cent.....	$ 9.32
Interest at 5 per cent and depreciation on plant at 10 per cent. for one year on $41,016.10	6,152.41
Rent of plant and grounds....	1,440.00
Taxes for 1909.....	608.23
Total fixed charges.....	$ 8,209.96

PLANT PRODUCT.

18,082 boxes wearing surface mixture, each 8.75 cu. ft...	158,217.50
5,031 boxes binder, each 9.00 cu. ft.	45,279.00
23,113 boxes total plant product, cu. ft.	203,496.50

SUMMARY OF EXPENDITURES.

General supervision		$ 2,543.27
Fixed Charges		8,209.96
Total		$10,753.23
General Expense:		
Supplies, Coal		$ 2,608.37
Wood		1,333.08
Oil, Grease, etc.		635.58
Cement (sweeping surface)		91.11
Superintendent's Automobile (operation		1,778.66
Dumping Privilege		1,355.65
Repairs to Plant		2,092.22
Repairs to Tools		1,144.35
Total		$11,039.02
Materials:		
18,082 Boxes (9 cu. ft.) wearing surface mixture: 1,420,854 lbs. Refined Asphalt at $23.50		$16,695.03
154,586 lbs. Refined Asphalt at $25.00		1,932.32
Total		$18,627.35
525.00 gals. Residuum Oil at $.07 3-8		$ 38.68
18,609.08 gals. Residuum Oil at $.09		1,674.82
		$ 1,713.50
Less credit on 444 empty bbls. returned at $ .50		222.00
		$ 1,491.50
264.925 Tons Stone Dust at 2.84		$ 752.38
192.2 Tons Stone Dust at $3.15		605.42
Tons, labor unloading		50.53
		$ 1,408.33
1,015 cu. yds. sand at $ .85		$ 862.75
6,166 cu. yds. sand at $ .87		5,364.42
		$ 6,227.17
Total cost wearing surface materials		$27,754.35
		$49,456.60
Materials:		
5,031 boxes (9 cu. ft.) binder mixture:		
144,484 lbs. refined asphalt at $23.50	$ 1,697.69	
16,000 lbs refined asphalt at $25.00	200.00	
	$ 1,897.69	
1,950 gals, flux at 9c	175.50	
601.5 cu. yds. binder stone at $1.40	842.10	
1,339 cu. yds. binder stone at $1.14	1,526.46	
	$ 2,368.56	
Total cost binder materials		$ 4,441.75
Concrete Materials:		
774 cu. yds. stone at 1.00	774.00	
1,372 lbs. cement at 1.25	1,715.00	
77 cu. yds. sand at 75c	57.75	
501 cu. yds. sand at 45c	225.45	
23 cu. yds. sand at $1.00	23.00	
Total cost concrete materials		$ 2,795.20
Plant Labor:		
Foremen, 300.25 days at $6.00	1,801.50	
Foremen, 69.25 days, at $4.00	277.00	
Engineers, 461.59 days, at $4.50	2,077.17	
Stokers, 966.86 days, at $3.00	2,900.58	
Asphalt workers, 4,100.89 days, at $2.50	10,252.23	
Laborers, 689.25 days, at $2.50	1,723.12	
Clerk, 6 days, at $2,100	40.38	
Total	$19,071.98	
Street Labor:		
Foremen, 2,341.04 days, at $4.00	9,364.17	
Engineers, 1,587.30 days, at $4.50	7,142.84	
Asphalt workers, 13,678.05 days, at $2.50	34,144.60	
Asphalt workers, 5,699 days, at $2.00	11,398.00	
Laborers, 68.50 days, at $2.00	137.00	
	$62,186.61.	
Trucking:		
Teams and trucks, 2,884.747 days, at $6.00	17,308.48	
Total cost labor and trucking		$ 98,567.07
Grand total of costs		$155,350.62

CURRENT INFORMATION

Good Government Pays—Municipal Garbage Collection—Cement in 1909—Passaic Valley Intercepter

Good Government Pays in Memphis.

One of the arguments advanced by the National Municipal League for the selection of right-minded public officers is that "it pays," and in proof thereof is the administration recently closed of James H. Malone, mayor of Memphis. Some of the things accomplished during his administration were:

Sixty miles of streets permanently paved; the construction of certain subways and the passage of ordinances for the construction of others, to eliminate railroad grade crossings; the development of the greatest park system in the South; the expansion of the artesian water system, now worth twice as much as the city paid for it; the extension of the city limits; the doubling of the fund for school purposes; the improvement of the health department until Memphis now ranks third among the cities of the United States in point of health; radical reforms in the methods and results of the city court, and the increase in the revenue, the improvement in the keeping of accounts of the city and in the collecting of revenue.

While all of these things have been accomplished, the tax rate actually was lowered during Mayor Malone's term from as high as $2.88 in the prior administration to $1.76 in 1909. When he entered office, the city's current debt was $200,000; when he retired, the city was doing business upon a cash basis and had no unpaid accounts. Memphis increased its property valuations from $66,000,000 to $84,000,000, with a great increase in population.

Cement Production in 1909.

The following preliminary estimate of the production of cements in the United States in the year 1909 has been prepared by Ernest F. Burchard, of the United States Geological Survey. The annual statistics of the mineral production of the United States are ordinarily collected by the Geological Survey only, but those for 1909 are being collected by the Survey in co-operation with the Bureau of the Census, in order to avoid annoyance to miners, manufacturers, and others by duplicate requests from government bureaus. This co-operative arrangement will necessarily result in considerable delay in the publication of the report on the cement industry for 1909 and for that reason many manufacturers requested the Survey to collect the data on cement in the usual manner. The Director of the Census approved the course requested, and accordingly the usual inquiries were sent by the Survey to cement producers. Owing to the conditions stated, these requests were sent out more than two months later than last year, but replies have now been received from about 88 per cent of the Portland cement companies in the United States.

As shown by the quantities reported in the replies received, to which has been added the estimated output of the small number of producers who have not yet responded, the production of Portland cement in 1909 was between 61,300,000 barrels and 62,000,000 barrels, which, valued at 85 cents a barrel, was worth at the mills between $52,105,000 and $52,700,000. This represents an increase in quantity of at least 10,227,000 barrels and in value of at least $8,557,000 over the production in 1908, which amounted to 51,072,612 barrels, valued at $43,547,679. The increase in quantity was therefore at least 20 per cent. over that of 1908. The reported selling price per barrel averaged the same as in 1908—about 85 cents—although Portland cement was sold during the summer of 1909 at a figure so low as to cause a general expectation that the average price for the year would fall below that of 1908.

The returns for the production of natural cement are not yet quite so complete as those for Portland cement, but they indicate that the total production in 1909 was not far from 1,500,000 barrels, valued at about $675,000, an average value of 45 cents a barrel. These figures show a slight decrease as compared with those for 1908, when the production was 1,686,000 barrels, valued at $834,509.

The production of puzzolan cement, as reported, shows a slight increase, about 160,646 barrels, valued at $99,453, having been produced in 1909, as compared with 151,451 bzarrels, valued at $95,468, in 1908.

The details of manufacturing developments and trade conditions will be discussed in the annual report of the survey on the cement industry, which is now in preparation as a chapter of the volume on "Mineral resources of the United States, calendar year 1909."

Objections to Passaic Valley Intercepter Withdrawn.

The action of Attorney-General Wickersham, May 3, in signing the stipulation under the terms of which the United

States withdraws its objection to the building of the Passaic Valley intercepting sewer, probably marks the destruction of the last serious obstacle or delay in the actual construction of the big drain. It is thought that the work of building the big flume will require about four years. It will be 26¼ miles long and will cost about $12,250,000.

Municipal Garbage Collection Proposed for Washington, D. C.

Abandonment of the present method of collecting garbage, ashes and refuse in the District of Columbia, was the purport of a bill introduced May 6 by Representative Cary, of Wisconsin, and proposing "that instead of having this work done under contract system it be taken charge of and directly disposed of under the direction of the superintendent of the street cleaning department of the District of Columbia."

Mr. Cary had previously introduced a resolution calling for an investigation of the local health department, on the ground that there is too much delay in the collection of garbage and rubbish of all kinds.

ORGANIZATIONS AND INDIVIDUALS

American Water Works Convention—American Highway League—Technical Meetings—Civil Service—Technical Schools—Our New Eastern Manager—Personal Notes.

American Water Works Convention.

The thirteenth annual convention of the American Water Works Association was held in New Orleans, La., April 26 to 30. The presentation of fewer papers this years than in former years was regarded generally as advantageous, and as a whole the convention was considered very successful. Among the papers were the following: "Electricity in Water Works Pumping," by Charles A. Burdick, of Chicago; "Municipal Improvements at New Orleans," George S. Earle, general superintendent of New Orleans water and sewerage board; "Water Meters," H. B. Rudisill, of Anniston, Ala., and A. W. Cuddeback, of Paterson, N. J.; "The Springfield Water Works," Allen Hazen, ficers were re-elected at the annual meet- New York City; "Conservation of Potable Waters," Secretary Diven; "The Cost of Furnishing Water," Daniel W. Mead, of Chicago, and Madison, Wis.; "A Co-operation Water Works Franchise," John W. Alvord; "Municipal Ownership," Park Woodward; "Fire Service Water Works, Winnipeg, Man.," H. N. Ruttan, of Winnipeg; "Creosoting Algae," Mr. Willcox, of Meridian, Miss.; "Pipes Under Railway Tracks," Willis B. Durlin; "Formulas for Making Water Rates," J. W. Ledoux; "Assessments for Water Main Extensions," Mr. Spaulding, of Springfield, Ill.; "Danger of Water Contamination Where Special Fire Services and City Mains are Interconnected," Alex Milne, of St. Catharines, Ont.; "Water Softening at McKeesport, Pa., and Winnipeg, Man.," Alexander Potter, of New York City; "Water Works Advertising," Dow R. Gwin, president of Terre Haute Water Works Co., Terre Haute, Ind.; "Operation of the Settling Basins, Richmond, Va.," E. E. Davis, of Richmond.

Committee reports were submitted as follows: "Electrolysis," Dabney H. Maury, chairman; "Depreciation," John W. Alvord, chairman; "Uniform Accounts and Reports," Albert H. Wehr, chairman; "Finance," H. A. Keeler, chairman; "Reorganization," Dabney H. Maury, chairman; "Fire Protection" and "Water Works Standards," Charles A. Hague, chairman.

John W. Alvord, of Chicago, was elected president, and John M. Diven was re-elected secretary and treasurer. The next convention will be held in Rochester, N. Y., in 1911.

American Highway League.

Representatives of twenty-five states met in a convention held in Chicago May 13 and 14, to take preliminary steps towards organizing a national highway commissioners' association. The name adopted is the American Highway League and its purpose is to study and discuss methods of highway administration, construction and maintenance; to secure effective co-operation between state highway departments interested in highway improvement. A. N. Johnson, M. Am. Soc. C. E., state highway engineer,

Springfield, Ill., was elected president, and Thomas H. MacDonald, state highway engineer, Ames, Ia., secretary. Mr. Johnson gave a talk on modern methods of macadam highway improvement, illustrated by stereopticon views. A special committee, with W. W. Crosby, chief engineer of the Maryland Highway Commission, as chairman, was appointed to obtain records and reliable statistics as to the wear and general efficiency of macadam treated in various ways and with various materials. Other subjects discussed were the following: (1) Highway bridges, particularly in regard to concrete structures and the work done by local contractors having little experience in this particular line; (2) standardizing specifications for road and bridge work; (3) guarantee bonds for paving and roads, with the view to abandoning the use of such bonds (which are usually impossible of collection or enforcement) or modifying them in such a way that they may be made effective; (4) highway administration, and the remedy of difficulties in the proper expenditure of road and bridge taxes in districts under other than municipal control; (5) the use of convict labor; (6) brick paving for highways (this is in use to a considerable extent in Ohio and has been tried elsewhere).

The latest number of the proceedings of the Merchants' Association of New York contains a brief appreciation of Walter C. Kerr, the late president of Westinghouse, Church, Kerr & Co. It also contains a preliminary report on the capital, earnings and rates of the express companies of the United States, and reports of the many valuable investigations and agitations which the association has instituted.

Technical Meetings.

A good roads convention will be held in Billings, Mont., June 16, 17 and 18, for the purpose of discussing ways and means for the improvement of the public highways of Montana, and to awaken a more general interest in that state in road building and improvement. The executive committee is composed of the following men: W. B. George, I. D. O'Donnell, P. B. Moss, W. S. Garnsey, H. W. Rowley, J. Collins West, E. B. Campbell, Christian Yegen, R. E. Shepherd and W. A. Selvidge, of Billings; W. M. Bickford and F. C. Largey, of Butte; J. C. McCarthy, of Bozeman; Frank M. Smith, of Helena; W. R. Allen, of Anaconda; A. W. Miles, of Livingston; W. A. Talmage, of Red Lodge; J. M. Keith, of Missoula, and C. F. Murphy, of Great Falls.

The American Water Works Association will meet in Rochester, N. Y., in 1911.

The annual convention of the Engineers' Society of Pennsylvania will be held at Harrisburg, Pa., June 1, 2, 3 and 4. E. R. Dasher, sec'y, Gilbert Bldg., Harrisburg.

The annual convention of the American Society of Civil Engineers will be held at Chicago, Ill., June 21, 22, 23 and 24. Chas. W. Hunt, sec'y, 220 W. 57th st., New York City.

The annual meeting of the Society for the Promotion of Engineering Education will be held at Madison, Wis., June 23, 24 and 25. Henry H. Norris, sec'y, Cornell University, Ithaca, N. Y.

The annual convention of the American Institute of Electrical Engineers will be held at Jefferson, N. H., June 27, 28, 29 and 30. R. W. Pope, sec'y, 33 W. 39th st., New York City.

The annual meeting of the American Society for Testing Materials will be held at Atlantic City, N. J., June 28, 29, 30, July 1 and 2. Edgar Marburg, sec'y, University of Pennsylvania, Philadelphia.

At the meeting of the Municipal Engineers of the City of New York, held May 25, Benjamin C. Marsh, secretary of the committee on congestion of population read a paper on "Economic Aspects of City Planning." A trip to Schenectady, Albany and Troy was made, leaving New York Friday night, May 27. On Saturday, June 4, an inspection will be made of the Erie Railroad improvements in Jersey City.

The proceedings of the sixteenth annual convention of the American Society of Municipal Improvements, held at Little Rock, Ark., last November, have just been issued in a well-illustrated volume of 432 pages. The next convention will be held in Erie, Pa., in November, 1910.

The Committee on Congestion of Population in New York, Prof. Frank J. Goodnow, chairman, has issued an interesting pamphlet giving "The True Story of the Worst Congestion in Any Civilized City."

President H. D. Sexton, of the East Side Levee and Sanitary District, East St. Louis, Ill., has issued the first report of its work, showing details of plans and of work thus far accomplished.

Edward M. Bassett, one of the Public Service Commissioners of the First District in New York, has submitted a valuable report on grade crossings in New York City and the need of change in the grade crossing law.

The second international road congress will be held in Brussels, Belgium, July 31 to August 7, 1910. The work of the convention will be divided into two subdivisions, one on construction and maintenance of pavements and roads in the large towns, and one on the same outside of such towns. Among the special papers are several on gasoline and steam motor rollers, road making tools, materials, sidewalks, removal of snow and ice, influence of weight and speed of traffic on bridges, relations of weight, speed and mode of propulsion on road wear, road signs, soft tires, statistics of traffic. The general subjects for discussion include comparisons of metalled and paved roads, binding

materials, foundations, drainage, construction details, light railways and tramways in roads, cleaning and watering, choice of pavement, etc. The American Road Builders' Association, 150 Nassau street, New York, has appointed a committee to organize a delegation from the United States, and the secretary, E. L. Powers, wishes to hear from those who propose to attend.

The American Museum of Safety now has an exhibit hall for devices to prevent accidents in the Engineering Societies Building, 29 W. 39th street, New York City.

The February number of the journal of the American Society of Engineering Contractors contains the papers presented at the special convention held in Chicago. The association recently held its annual election of officers, which resulted in the re-election of the former list of officers. D. E. Baxter is president and Daniel J. Hauer is secretary, 13-21 Park Row, New York City. Indiana has the first local branch, with Ralph M. Snyder, of Fort Wayne, as president, and Charles C. Brown, of Indianapolis, as secretary.

The National Fire Protection Association met in Chicago, May 17, 18 and 19, and heard reports from the numerous committees to which the work of the association is assigned, and also addresses by Irving K. Pond, president of the American Institute of Architects, on "The Architect and Fire Protection," and F. S. Baker, president of the Royal Architectural Institute of Canada, on "Fire Insurance versus Preventive Measures in Building." Delegates to conventions of other associations also reported.

The second national conference on city planning and the problems of congestion, held at Rochester, N. Y., May 2 to 4, followed the program outlined last month and did much valuable work.

The Cement Products Exhibition Co. reports the cost of the great Chicago cement show to have been $41,721.65, and the company has the uncomfortably small balance of $785.08 on hand. The old offing, Edward M. Hagar being president, J. U. C. McDaniel, secretary and treasurer, and B. F. Affleck, chairman of the executive committee.

The year book of the Civic League of St. Louis contains lists of members, officers and committees, Harry Pratt Judson's address at the annual meeting on "Civic Righteousness," the president's statement, and reports from the league's committees on all lines of its work.

At the meeting on May 11 of the New York Electrical Society, T. Thorne Baker, of London, Eng., lectured on "The Transmission of Photographs, Wireless and by Wire."

At the meeting of the Brooklyn Engineers' Club, May 12, Richard L. Russell read a paper on "Contractors' Cost Keeping and Organization," describing methods and showing typical record forms. The club inspected the new Pennsylvania Railroad's New York City terminal, electric locomotives and tunnel.

The International Exhibition of Railways and Transport, at Buenos Aires, has opened and will continue until November. The exhibition buildings were most of them completed well in advance.

The next tournament of the Wisconsin State Firemen's Association will be held at South Milwaukee, June 22, 23 and 24. J. H. O'Connell, corresponding secretary, South Milwaukee.

The convention of the International Association of Fire Engineers will be held at Syracuse, N. Y., August 23, 24, 25 and 26. James McFall, secretary, Roanoke, Va.

The Louisiana State Firemen's Association held its annual convention at Lafayette, May 27, 28 and 29.

The International Association of Chiefs of Police will hold its convention in Rochester, N. Y., during the month of June. Harvey O. Carr, secretary, Grand Rapids, Mich.

The Association of Chiefs of Police of Ohio will meet at Chillicothe in August.

Civil Service Examinations.

The U. S. Civil Service Commission will hold examinations at the usual places on June 15 for men to fill at least fifty vacancies in positions as surveyors at $1,400 a year in the Philippine service.

The Technical Schools.

The new building for the engineering department of Union College was dedicated on April 28 with appropriate exercises, including an address on "The Limitations of Efficiency in Engineering Education," by Prof. Geo. F. Swain, of Harvard University, one by Edward W. Bemis, deputy water commissioner in New York City, on the training needed for engineers in the public service, and formal speeches by Dr. Andrew S. Draper, State Commissioner of Education; Dr. Franklin H. Giddings, of Columbia University, and President Garfield, of Williams College.

The February bulletin of Purdue University, just issued, contains the annual catalog for 1909-10.

"A Study in Heat Transmission," by J. K. Clement and C. M. Garland, is issued as Bulletin No. 40 of the Engineering Experiment Station of the University of Illinois. The bulletin describes a method of studying the effect of the agitation of a medium in contact with metal walls upon the heat conducted through these walls and to or from the medium. Results of experiments upon the heat transmitted to water as the medium in contact with the walls of a tube, under varying velocities or rates of agitation, are given.

The Stevens Institute of Technology, Hoboken, N. J., is asking from Congress the return of $45,750 (with interest)

promptly paid by the institute in accordance with a law requiring such payment as a tax on the Stevens bequest, whereas other institutions in similar condition delayed payment until a law could be passed relieving them of the tax, so that the institute suffers from its promptness in paying its bills.

Bulletin No. 216, of the University of Wisconsin, contains the first report of investigations made of the flow of water through large submerged orifices and tubes. This volume contains descriptions of experiments and statements of results with tubes 4 feet square, by Clinton Brown Stewart, C. E., and makes some important additions to our knowledge of this subject.

"Tests of Washed Grades of Illinois Coal," by C. S. McGovney, is issued as Bulletin No. 39 of the Engineering Experiment Station of the University of Illinois. This bulletin presents the results of an elaborate series of boiler tests made in connection with a 210-horse-power brick-set water-tube boiler, equipped with a chain grate stoker. The fuel employed was washed Illinois coal of the various sizes commonly used for steam purposes. The description of the plant, the methods employed and the results of the tests are given in detail.

The University of Tennessee, Knoxville, has issued the thirteenth edition of its little book of "Tables and Other Data for Engineers and Business Men," which is compiled by Prof. Chas. E. Ferris, and is a convenient compendium of the most commonly used tables in civil and mechanical engineering and business, and of information about the university. It costs 50 cents.

A late issue of *The Tech*, published at the Massachusetts Institute of Technology, Boston, contains a history of the department of civil engineering and sketches of the courses and of the professors in charge of them, illustrated by their portraits.

Our New Eastern Manager.

We wish to announce the recent appointment of Mr. B. E. Mitler to the position of Eastern manager of the Municipal Engineering Co. He now has charge of our Eastern office at No. 1 Broadway, New York City.

For the past four and a half years Mr. Mitler has been actively engaged in the technical publishing field with the McGraw Co., of New York, publishers of *Engineering Record, Electric Railway Journal* and *Electrical World.*

We shall be glad to have our friends in the Eastern territory confer with him whenever they desire information relative to the municipal field.

Personal Notes.

Hon. Lee Offutt has been elected mayor at Rockville, Md.

Robert E. Joyce has been elected mayor at Mt. Rainier, Md.

Carl E. Plum has been reappointed city engineer at Elgin, Ill.

Martin A. Feeney has resigned as city engineer of Butte, Mont.

Clarence B. Wilson has been elected mayor at Glen Echo, Md.

Hon. E. D. Kingsley has been re-elected mayor at Gaithersburg, Md.

Hon. John A. Cannon has been re-elected mayor at Kensington, Md.

H. G. Lykken has been appointed city engineer at Grand Forks, N. D.

Hon. William P. Magruder has been re-elected mayor at Hyattsville, Md.

W. K. Greenwood, of Toronto, Ont., has been appointed town engineer of Orillia, Ont.

George Retting has been appointed superintendent of city forestry at Cleveland, O.

Maurice H. Thatcher has been appointed a member of the Isthmian Canal Commission.

The Sargent Steam Meter Co., Chicago, Ill., has moved its office and laboratory to 153-158 Lake st.

Frank C. Kelsey has resigned from the Nisqually water power project for the city of Tacoma, Wash.

F. K. Rader has been placed in charge of the engineering work of the park department at Atlanta, Ga.

William G. Platt has been re-elected mayor, and L. R. Grabill, R. D. Rush and H. F. Taff, councilmen, at Takoma Park, Md.

J. R. Preber has been appointed chief engineer to take charge of the new Green river water supply system for Tacoma, Wash.

Charles Lyon McIntosh, treasurer of the J. I. Case Threshing Machine Co., of Racine, Wis., died at Naples, Italy, April 19.

John L. Ray, superintendent of the Calais division of the Maine Water Co., died at his home in Milltown, N. B., after a short illness.

William Storrs MacHarg, M. Am. Soc. C. E., consulting engineer of the Chicago department of public works, died May 6, aged 63 years.

J. J. Brooks, Jr., general sales manager of the Harbison-Walker Refractories Co., Pittsburg, Pa., has been elected to its directorate.

Prof. Arthur H. Blanchard, of Brown University, has recently been elected a member of the Societe des Ingenieurs Civils de France.

The Standard Bitulithic Co. has removed its offices to the Hudson Terminal Building, 50 Church st., corner Fulton st., New York City.

Prof. J. C. Nagle, professor of civil engineering in the Agricultural and Mechanical College of Texas, has been appointed city engineer of Bryan, Tex.

H. V. Joslin has been appointed assistant engineer in connection with the investigation now under way for a new water supply for Norfolk, Va.

The A. W. Erickson Advertising Agency has moved its offices from 127 Duane st. to the Fourth Ave. Building, Fourth ave., corner 27th st., New York City.

Alton D. Adams, Worcester, Mass., has been employed by the city of Binghamton, N. Y., to report on the development of a water power on the Susquehanna river

and the cost and operating expenses of an electric plant for municipal lighting.

Hon. John Wesley Stone has been re-elected mayor at Garrett Park, Md.

A. H. Dahlow, Francis Gasch, John Haynes, Marion Duckett and Frederick Hiller have been re-elected members of the town board at Bladensburg, Md.

Bernard J. Mullaney, formerly secretary to Mayor Busse, of Chicago, has been appointed commissioner of public works, to succeed John J. Hanberg, resigned.

John E. McKay, who has been continuously in the service of various engineering departments of New York City since 1872, died at White Plains, N. Y., May 12.

W. P. Cowler has been appointed resident engineer of the Minneapolis civic commission, which is studying, under the direction of E. H. Bennett, of Chicago, a civic improvement plan for Minneapolis.

G. R. Ellis has been appointed city engineer of Columbia, Mo., succeeding D. B. Duncan, who resigned to become a member of the contracting firm of Davis & Duncan.

James R. Marker has been appointed chief engineer of the Ohio state board of public works, at Columbus, O., succeeding Charles E. Perkins, who held the position for 18 years.

William T. S. Curtis has been elected president, and G. W. F. Swartzel, Vernon E. Hodges, A. A. Hoehling and John L. Weaver, members of the board of trustees at Chevy Chase, Md.

MACHINERY AND TRADE

The Snell Open-Drum Concrete Mixer.

The distinctive feature of the Snell concrete mixer is the drum. In the smaller sizes it is cylindrical and made in one piece. In the larger sizes a truncated cone is added to reduce the space on which the mixture is discharged. The joints are thoroughly riveted and are water-tight. The interior of the drum is perfectly smooth except for five small parallel blades riveted to the drum at right angles with the bottom. There are therefore no pockets or interior mechanism to be clogged with concrete.

The drum is mounted on a cast iron pan, which forms its bottom, and carries the gearing for revolving the drum. The whole drum rests on one ball bearing in the center of the cast iron bottom, as far from danger of damage from concrete as possible. The whole outer end of the drum is open.

The drum is operated by a gasoline engine through gearing, and is so mounted that it can be tilted from one side to the other. In some of the designs the drum is tilted to one side and the concrete materials are dumped from wheelbarrows or shoveled into it. Being only 36 inches from the ground, it is easy to arrange a platform for dumping in the materials with the least possible handling. The drum is revolved, and when in position for the best mixing its axis stands at an inclination of 45 degrees. The pouring process of the revolution and the blades mixes and kneads the aggregate at least a hundred times a minute, and the entire time of loading, mixing and dumping a batch is normally two minutes. When the mixture is complete the drum is tilted to the other side, still revolving, and the concrete drops out. The tilting mechanism in all but the smallest size of mixes is operated by a worm gear run by the engine, but can be operated by hand, the drum being so well balanced that it can be tilted with one hand. The tilting mechanism is operated from the loading platform, so that one man does the loading and discharging and can give full or partial discharge as desired, full discharge meaning a clean drum.

In some of the designs the loading platform is between the engine and the drum, the drum tilts toward the platform for filling and tilts to the opposite end of the truck for discharging.

The open drum makes inspection of the concrete easy, and so the thoroughness of the mixture and the amount of water can be judged to a nicety.

The various sizes are suited for heavy construction work, with batch of 18 cubic feet; for paving and sidewalk work, with batch of 10 cubic feet; for small contractors, with batch of 7 cubic feet, and a very small design, with batch of only 2½ cubic feet.

These mixers are made by the R. Z. Snell Manufacturing Co., South Bend, Ind., who will give any additional information desired.

Iron from Mine to Pipe.

The Lynchburg Foundry Co. have long been known as among the most progressive of the independent manufacturers of cast iron pipe. They have insured their independence by purchasing, through the Anniston Iron Corporation, which they control, the Woodstock iron properties at Anniston, Ala., with two blast furnaces, and the Milner Coal and Railway Co., at

Newcastle, Ala., with coal lands, coke ovens and facilities for mining a thousand tons of coal a day.

These properties will supply the foundries of the parent company with 50,000 tons of pig iron a day. The present plants at Lynchburg and Radford, Va., will be increased by a new plant at Norfolk, Va.

The 72-Inch Steel Pipe Line of the Brooklyn Water Supply.

The borough of Brooklyn, city of New York, takes its water supply from wells, infiltration galleries and ponds stretching over a distance of 23 miles along the south shore of Long Island and extending eastward to the Suffolk county line, about 30 miles east of the Borough Hall. The water is drawn from the wells, galleries and ponds by pumps in 24 isolated stations and delivered into large trunk mains.

It became apparent some years ago that further increase in the supply was necessary, and accordingly the Department of Water Supply, Gas and Electricity, having charge of the Brooklyn water system, determined on an increase in the number and capacities of its sources and pumping stations, and in the means of bringing the additional supply to Ridgewood reservoir, which is the main distributing center of the city distribution system. The new trunk main decided upon was a 72-inch steel pipe 24½ miles long, to be operated as a force main delivering direct to the distribution system and discharging the excess supply by an overflow connection into Ridgewood reservoir. Its capacity will be from 50,000,000 to 60,000,000 gallons per day.

The line extends from Valley Stream eastward to the Suffolk county line, in general parallel with and a short distance away from the right of way of the Montauk division of the Long Island Railroad. It is laid on a private right of way, in some places 100 feet and in others 200 feet wide. Being a pressure pipe, it is not laid on a gravity grade, the maximum gradient being 1 per cent. The maximum curve has a radius of 200 feet. In order to pass around curves the ends of the pipe are cut to a suitable bevel. The line consists of a circular steel plate pipe with an inside diameter of 72 inches, single-riveted circular joints and longitudinal joints made with "lock bar." It was manufactured by the East Jersey Pipe Co., at Paterson, N. J., for the contractors, T. A. Gillespie Co.

The pipe is made up in lengths of 30 feet, each weighing approximately 12,000 pounds and each length is coated while at a temperature of 350 to 400 degrees Fahr., with Sarco mineral rubber pipe coating.

The pipe coating specification was as follows:

After testing to the satisfaction of the commissioner of water supply, gas and electricity, or his authorized representative, the pipes shall be thoroughly cleaned and all grease, dirt, loose scale and rust removed, and then heated in a suitable oven to 350 to 400 degrees Fahrenheit, after which it is to be dipped vertically in a bath of mineral rubber pipe coating, equal to that manufactured by the Standard Asphalt and Rubber Co., of Chicago. This coating must be durable, smooth, hard, tough, perfectly water-proof and strongly adhesive to the metal, and must show no tendency to flow when exposed to the sun in summer, or to become so brittle as to scale in winter. It must be free from blisters and bubbles. The bath must be heated in such a manner as to insure a constant and even temperature of 400 degrees Fahrenheit. The coating shall be not less than 1-32 inch and not more than 1-16 inch thick, and must be a high resistant against electrolytic action. The material used for this coating must be shown by analysis to contain not less than 99.3 per cent. pure bitumen, consisting of not less than 70 per cent. petrolene (soluble in petroleum ether) and not more than 30 per cent. asphaltene (soluble in chloroform). The dipping material must be kept pure and free from sand, grit or other foreign material. To attain this, the contractor must, as often as it is necessary in the opinion of the engineer, empty the tanks of their contents, clean and refill them with pure material. The consistency of the material must also be kept uniform by the addition from time to time of suitable flux. Samples of the material proposed to be used for coating must be submitted to and approved by the commissioner of water supply, gas and electricity, or his authorized representatives.

Upon the completion of the riveting and calking, the seams are carefully painted with Sarco mineral rubber field coating, made from the same material with which the pipes are coated at the shop. When this work has been finished on a complete section from one line valve to another, the pipe is filled with water and tested to a pressure of 175 pounds per square inch, and upon being found tight the back-filling is commenced.

The contractor employed on the average, including the excavating, pipe-laying, riveting, calking and back-filling gangs, about 1,000 men. The contractor for the work is the T. A. Gillespie Co., of New York City, with Mr. M. J. Coffey, superintendent, in charge. The cast iron pipes for blow-offs and the cast iron specials were furnished by R. D. Wood & Co., Philadelphia, and the steel castings were supplied by the Taylor-Wilson Manufacturing Co., of McKees Rocks, Pa.

Mr. Walter E. Spear, chief engineer for the Department of Water Supply, Gas and Electricity, borough of Brooklyn, New York City, was in general charge of the work, and Mr. B. M. Wagner was division engineer directly in charge of construction.

Sarco mineral rubber pipe coating was supplied by the Standard Asphalt and Rubber Co., 205 La Salle street, Chicago, Ill.

The accompanying cut shows sections of the pipe on the line ready to lay.

SEVENTY-TWO-INCH STEEL PIPE OF BROOKLYN WATER WORKS.

From Valley Stream, Long Island, to Amityville, Long Island (City of New York.) Protected with Sarco Mineral Rubber Pipe Coating.

What Is Concrete Mixing?

The Chicago Cube Mixer Co. define mixing concrete as smearing or luting each particle of sand with cement paste and each particle of aggregate with mortar paste. Disintegration is not mixing. The mere fact of separating two particles and placing another between them does not constitute mixing, because to insure a perfectly intimate and homogeneous mixture, both pressure and grinding of the ingredients are required. To prove this, take a small pebble, say an inch or so in diameter, lay it down and pour water over it. Immediately, and before the water has time to dry, sprinkle cement over it until water is absorbed, and set it away to dry. The next day the cement can be lifted off in the form of a small cap. The reason for this is that the cement was not ground and pressed into actual contact with the pebble, the film of water effectually preventing contact of the two materials.

Cement paste is usually a very wet and sticky material. The only way that it can be made to cover the sand and aggregates is to rub the various particles together until each coarser particle is smeared with a paste of the next finer particles. Go into a testing laboratory and watch the expert there mixing cements and mortar pastes for test briquettes. An intimate and homogeneous mixture is above all things essential here. Note how it is secured. The operator has formed a small cone of sand and cement, with a crater in its top filled with water. With his fingers he folds the sides of the cone over into the water until the water is soaked up. Then he begins to mix. Arching his hands over the mass, he pulls it under the palms with his fingers, at the same time pressing the palms forward and downward, squeezing and grinding the particles together. The flattened cake is then folded up into a new cone and the mixing operation is repeated. This is an example of perfect mixing.

What the cement tester does with his hands and a few ounces of paste, the Chicago improved cube mixer does with its cubic yard or so mass of stone, sand, cement and water. The larger mass is not spooned or stirred any more than is the smaller mass; it is folded, refolded, squeezed and pressed into a homogeneous mass of mortar and cement-coated particles.

Almost any concrete looks good in the wheelbarrows, but in a test great variations in strength will be found. One of the reasons for this is that nearly all crushed stone, unless washed, is coated with a thin film of very fine dry dust. Nearly all gravel contains more or less clay or loam with which the coarser parts are covered. This dust, or coating of clay, positively must be ground away and the clean stone laid bare before the cement can get an actual contact with it. Mixers which act as disintegrators will not do this because the weight of the mass of ingredients is broken up into very small parts as it is separated and carried up inside the drum. In the Chicago improved cube mixer the batch is kept in one mass and the entire weight of the whole rests on the lower particles. As the entire batch is always in motion, each particle is constantly rubbing against some other particle as the mass is folded and refolded upon itself; there is a great crushing, grinding and kneading of the ingredients until every pebble or piece of stone is perfectly smeared with a coating of cement paste that is ground and squeezed into actual contact with a clean solid surface.

The Chicago Cube Mixer Co., Railway Exchange Building, Chicago, Ill., will send full information about the mixer.

Testing Laboratory Apparatus.

Chicago has a factory for the manufacture of laboratory apparatus for making tests of asphalt and cement, at 2014 Nebraska ave., operated by the Humboldt Manufacturing Co. Their price list contains the latest apparatus, some not elsewhere obtainable, including Kirschbraun's cementation and ductility machine, penetrometer, floor plate and briquette mold, all for asphalt, and all the standard apparatus for preparing cement for test for tensile and compressive strength, permeability, weight, specific gravity, fineness, etc.

Dryer and Heater for Broken Stone, Grit, Sand and Gravel.

The paving contractors, roofers and road builders of New York are this year using a new, economical and most convenient method of heating and drying their sand, grit, gravel and broken stone. Formerly this has been done in very crude ways, some sticking a cast iron pipe through a pile of gravel and making a fire therein, some placing the gravel on a flat iron plate raised from the ground on stones and building a fire thereunder. In either case much labor, patience, time and fuel were consumed, and very little gravel was dried and heated, for the gravel was never brought into a practical relation to the fire, and the fuel was mostly expended in heating the surrounding atmosphere instead of the gravel.

But one man is required to attend the machine now in use to supply hot dry gravel for a large gang. He builds and tends the fire, shovels cold wet gravel into the hopper above, and loads same into wheelbarrows, hot and dry, from the bottom of the heater, a few minutes later. This man does not need to work overtime.

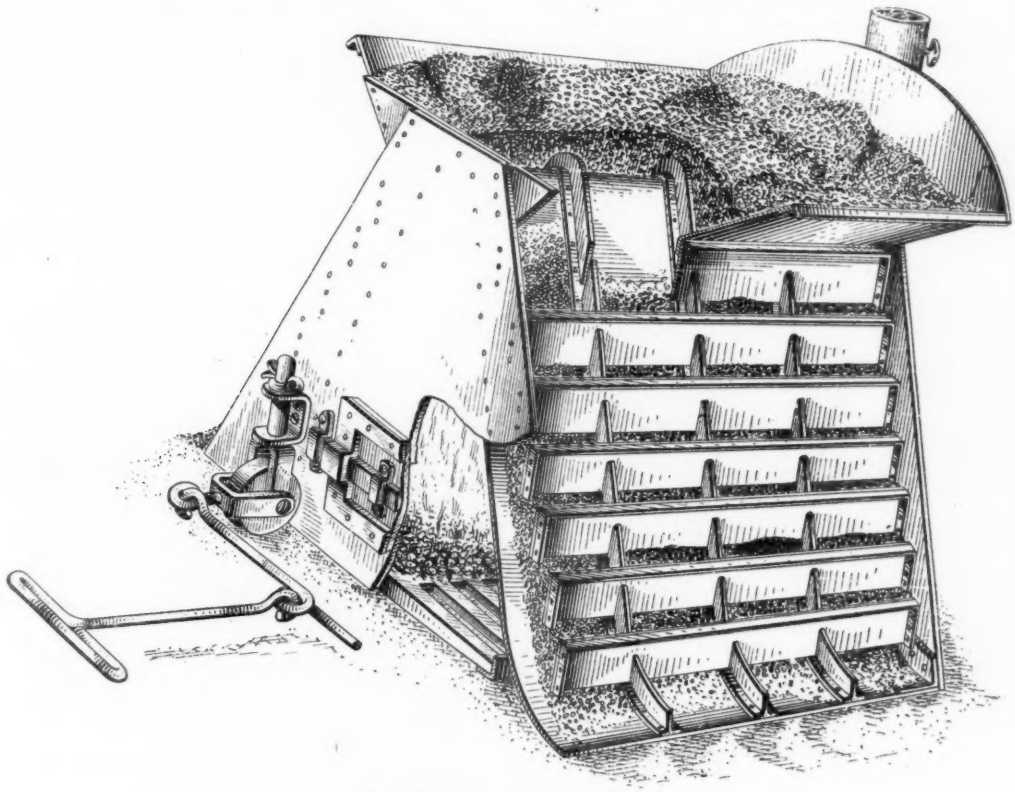
It is surprising what a small amount of fuel is required to heat and dry a large amount of material. To understand the reason for this one must know the con-

struction of the apparatus, when it is readily seen that not one particle of heat escapes into the outer air without having done its work of drying and heating the gravel.

The structure, shown in the accompanying cut, is remarkably strong and simple. The furnace consists of a perforated sheet of metal bent over roof-like, to form the two heating sides, and solid endplates, in which are fire door, flue, etc. There is a hopper above. Arranged down each perforated furnace side is a series of inwardly deflecting flights, also perforated. The gravel descends from the hopper into the space between the perforated furnace sides and the flights, where it is held in a thin layer while being dried and heated. When it is sufficiently hot and dry it is removed from the bottom of the heater, more gravel flowing in to take its place from the hopper above, thus forming a continuous process. The degree of temperature to which the material is heated can be easily regulated by the length of time it is allowed to remain in the heater and the amount of fuel used.

When the fire is well started, the damper in the flue is choked off. The draft and heat are thus forced to pass out through the perforations in the furnace sides, the voids in the about 4-inch layer of gravel held against same, and then out through the perforations in and the spaces between the inwardly deflecting flights. A more complete utilization of all the heat and products of combustion can hardly be imagined, for they cannot escape doing their work of drying and heating on their way out through the perforated sides and the voids of the gravel, and they have no means of escape except through these myriad tiny flues.

The efficiency of this idea is easily realized when one considers that cold wet gravel can be loaded into the machine, a fire built under it, and, in less than fifteen minutes, the first hot dry gravel is ready for use. After that it is a continuous process, the heater shown having a capacity of about five tons per hour or fifty tons per ten-hour working day, with one man tending the machine and a minimum consumption of fuel.



THE MULLEN GRAVEL HEATER.

It is claimed for this heater that it saves time, labor, fuel and money, is a very great convenience, and will pay for itself in less than three months.

Another invention is a combination tar-pot and gravel heater built along the

same lines. One of these was constructed especially for the Third Avenue Railroad Co., for use in repairing granite block pavement with tar and gravel joints along their rails on Forty-second street, near Broadway, New York City. It is believed that this newly introduced invention will prove of the greatest value to contractors doing roofing, paving and road building where it is necessary to heat and dry sand, gravel, broken stone or grit along the line of the work for instant use.

The inventions were made by Mr. Chas. A. Mullen, of New York City, himself a contractor, for years engaged in asphalt, bituminous and granite block paving work. He has made a systematic study of heating and drying coarse materials, of which the above described inventions, we are told, are but the first expression. His idea is to overcome the expensive and troublesome methods now in use at asphalt and other paving plants throughout the country. The Tide Water Iron Works, of Hoboken, N. J., are the sole licensed manufacturers.

The Shannon Sewer Cleaner.

The Shannon sewer cleaner was devised by contractors for daily use in their own work, and so it is a practical machine, directly suited to the demands made upon it. It consists of a trough with rounded, shovel-shaped ends, a movable cover and a flap valve.

To operate it a rope is passed through the sewer from one manhole to the next, and this rope passes through a pulley fixed at the bottom of the second manhole by means of a brace temporarily set in the sewer. This gives the opportunity for drawing the cleaner through the sewer from the first manhole to the second, by means of a windlass set on the street over the second manhole. When the cleaner has been drawn to the second manhole, the line which holds the pulley above mentioned is slackened off from above, allowing the pulley, cleaner and all to be hauled to the surface. The cover is then removed by drawing a couple of bolts and the cleaner is emptied into the attendant wagon or on the street. The cover is replaced and the cleaner is ready for another trip.

There are lugs on the cleaner which serve to keep it upright, and also to allow the cutting edge to pass over slight obstructions at pipe joints.

The complete outfit includes two windlasses and three special blocks with chains and shackles, so that the cleaner can work in both directions through the sewer, 600 feet of steel wire rope, with the necessary clamps, and four cleaners, one for 8 and 10-inch pipe, one for 12 and 15-inch pipe, one for 18 and 24-inch pipe, and one for sewers over 2 feet in diameter. The machines will be sold outright or will be rented at a fixed price per month.

After the first rope is passed through the sewer and the braces are set, it is not necessary for a man to enter the sewer until the cleaning is done. Three men can operate the whole apparatus.

Engineers and contractors who have used the machine say that it is effective and that the cost of cleaning is low as compared with other methods used by them. The apparatus is now sold by the Hayden Machinery and Supply Co., 30 Church st., New York City, who will send any further information desired.

High-Grade Engineering Instruments.

The Hanna Manufacturing Co., Troy, N. Y., issue a well-designed and executed catalog, which is an indication of the quality of the instruments they make. They have a full line of engineers' transits of several designs, including light mountain, explorers' and reconnoissance transits, also engineers' and architects' levels, solar attachments, current meters, sextants, leveling rods, barometers, tapes, rods, poles, etc. They have the Verschoyle pocket transit also.

Clark Brown's chart method of reducing polaris observations is set forth in full in the catalog, which contains much other useful information about various instruments, their construction, care, adjustment and use. Copy of the catalog will be sent on request.

Specifications for Reinforcement Bars.

The Association of American Steel Manufacturers has adopted standard specifications for concrete reinforcement bars, copies of which can be obtained by addressing the secretary, Jesse J. Shuman, care Jones & Laughlin Steel Co., Pittsburg, Pa.

The specifications cover the process of manufacture, the chemical and physical properties, method and number of tests, number of twists, finish and variation of weight. The physical properties are fixed within limits for structural steel grade, hard grade and cold twisted bars.

The Passing of Old-Style Macadam.

Macadam's science has had its day. The principles of this famous Scotch engineer have been faithfully followed for some sixty years, but the coming of the automobile has brought the period to a close. Macadam's roads have been thoroughly satisfactory for Macadam's traffic, but he did not build surfaces that were calculated to stand the powerful shearing action of automobile wheels. The big pneumatic tires, carrying each a half ton's weight, press themselves closely against the brittle macadam surface, and then, with the power of forty horses, the heavy car is driven forward by the backward thrust of the tire against that surface. The result is inevitably the speedy loosening of the surface. No surface less hard than tar macadam would

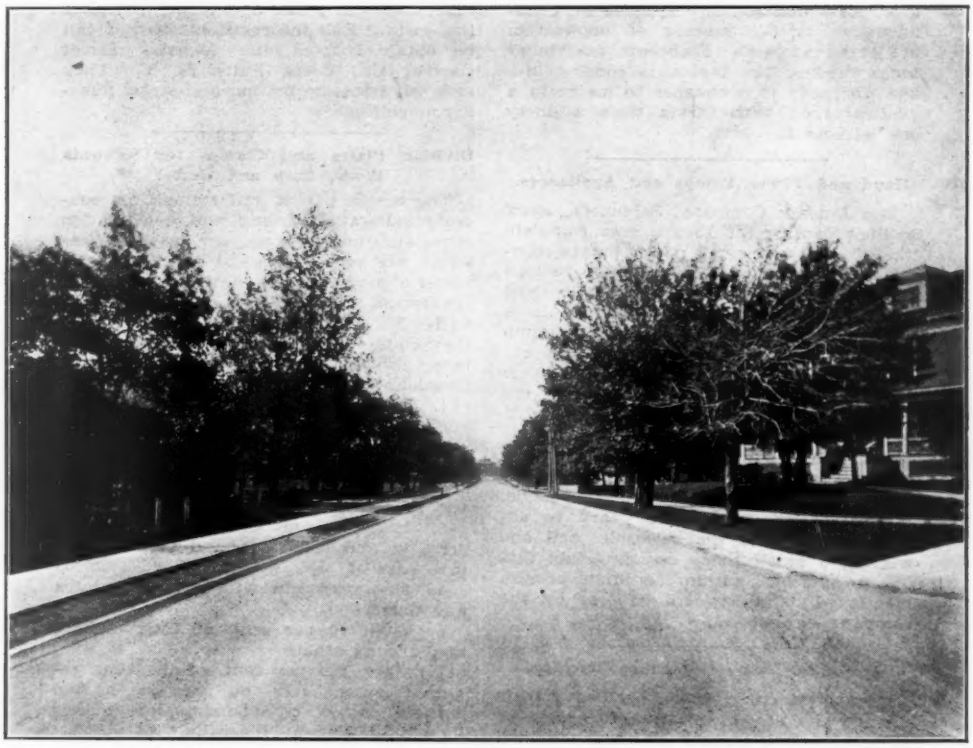
fail to crumble under such a strain, so the result is a cloud of dust, and the fine crushed stone which the engineer has carried for miles to place upon the road surface is scattered recklessly over adjoining lawns and trees, not to mention the faces and clothing of pedestrians and residents.

A completely new science of road building has therefore begun during the past five years, and is now well advanced.

The modern engineer builds his roads with tarvia, a coal tar product, which gives to his surface an element of plasticity. The tarvia is a dense, pitchy substance of considerable adhesive power. When it is poured over the macadam and allowed to soak in it fills the voids and hardens into a tough, elastic matrix, from which the stone particles do not come loose. The thrust of automobile wheels on this surface does not make it crumble or pulverize.

The tarvia applications vary according to the conditions of the road and the thoroughness with which the surface needs to be protected against automobile wear. Many roads are now being built using tarvia from the foundation up to the top. A very dense kind of tarvia, known as Tarvia X, is used. It is poured over the stones until every stone is thoroughly coated with it and the voids are well filled. Then the smaller crushed stone of the upper course is spread and rolled into the tarviated bed. The finished surface is a mosaic, a kind of tarvia-concrete, smooth and water-proof.

Tarvia can also be applied to roads that are built in the old way, although the application, being confined to the surface, is naturally less thorough. The kind of tarvia known technically as Tarvia A is painted over the road after it has been carefully swept to clean away surface dust and debris. The tarvia soaks into the macadam while it is hot, and then cools, making a tough, firm matrix for the stone.



DELTA AVENUE, ESCANABA, MICH. TREATED WITH TARVIA A.

A cheaper process is the Tarvia B process. Tarvia B has less solid base than the other kinds, and is liquid while cold, so that it can be used in an ordinary sprinkling cart without heating. It can only be used on roads that are thoroughly compacted and with smooth surface. It gives a good, dustless road which will withstand automobile traffic.

Of the three types of application, the Tarvia X process, which involves the use

of this material from top to bottom of the road, is the most thorough and most satisfactory in the end. A road so built will retain its evenness of contour almost indefinitely. Water and frost have practically no effect upon it, and the only deterioration which it suffers is from the actual friction of traffic.

Some engineers have reached the point where they are so well satisfied with tarvia processes from the standpoint of economy that they consider it unwise to build roads in any other way.

It is the settled policy of some towns to build all new roads in this way. As the new road building science develops, refinements in the process of application are being adopted. Elaborate machinery for spreading the tarvia is coming into use. Already it is cheaper to maintain a dustless road with tarvia than a dusty one without it.

Hand and Power Pumps and Appliances.

The Deming Company, Salem, O., show in their catalog for 1910 a very complete line of hand and small power pumps, containing over two dozen pumps of various designs and weights, from the little hand pump, weighing 9 pounds, for use in a bucket, to an outfit consisting of a pump run by a 3½-horse power gasoline engine, to pump from a tank on the same truck, and an auxiliary pump to fill the tank, the whole weighing about 2,725 pounds.

These outfits were developed originally for use in spraying vegetation, and can supply a pressure up to, say, 125 pounds. Pumps, tanks, trucks, etc., vary in design according to the demands, and one wishing a small pump can probably find one to suit him within the limits of size mentioned. Catalog will be sent by the company on request.

A Sanitary Street-Cleaning Machine.

Any city having reasonably heavy traffic over its streets requires for some of them a certain amount of hand cleaning, and the Menzies machine, which is operated by hand, has been devised to fill the demand. It consists of a two-wheeled cart, strongly built of iron and steel throughout, with castings of malleable iron, and a galvanized iron dust pan, with a spring steel blade 28 inches long and 6 inches wide, hung on the axle of the cart.

In operation the machine is pushed to the part of the pavement to be cleaned, the dust pan is lowered to rest on the pavement a little beyond the dirt to be gathered up, and an ordinary street broom is used to sweep the dirt over the blade into the dust pan. When the dust pan is filled, the operator steps to one side, grasps the handle with one hand, gives the machine a slight forward motion, raises the handle and the pan and dumps the dirt into the can set on the platform of the cart. The pan is then lowered and is again ready for use.

The platform on which the can sets is very near the ground, so that when the can is full it can be set off at the curb or elsewhere with ease and an empty can put in its place on the cart.

Shovel and scraper are not needed and the workman can clean about 50 per cent. more street than with the ordinary broom and pan, shoveling the dirt into an attendant cart.

The machine is very valuable also for use in parks, cemeteries, depots, hotels and public gathering places in and out of doors. Cart, can and broom complete the outfit. Full information about it can be obtained from the Menzies Street Cleaner Co., Glens Falls, N. Y. They also sell street sprinkling and street flushing machines.

Division Plates and Clamps for Sidewalk Work, Curb and Gutter.

The Smith patent rail clamps for concrete sidewalk, curbing and combination curb and gutter work are new devices which are very convenient and save much material and labor in setting and removing forms. S. C. Smith & Son, of Waverly, N. Y., are the manufacturers, and they claim the following points of advantage, which the writer thinks are well founded:

1. They are not expensive and are guaranteed to give satisfaction.
2. The same clamps can be used on all widths of walk, all widths of curbing, and all widths and shapes of combined curb and gutter.
3. There are no wedges to make and drive in and drive out, and pick up and take care of.
4. One man can withdraw the plates and finish.
5. Save 80 per cent. of time making and driving stakes.
6. Save 100 per cent. of the time required going back and patching broken corners caused by pounding the stakes loose in taking up the rails.
7. Save 100 per cent. of the time of going back after the rails the following day, as the rails are all loose and can be taken the same day the work is finished.
8. In laying walks over a fill you do not have to make and drive stakes 3 or 4 feet long; the clamps do the trick.
9. If you have steel division plates ⅛, 3-16 or ¼-inch thick, our clamps will fit them, and all you have to do is to drill a ¼-inch hole in each end of your plates.

A Deep-Well Pump.

The Downie double-stroke deep-well pumps are designed for elevating large quantities of water from great depths. They are better and more strongly made than usual, and so they cost a little more, but the makers claim they are much cheaper to run.

One special aim has been to eliminate the liability to derangement which is peculiar to deep-well pumps.

Much power is required to lift a heavy column of water, but the geared pump works with an efficiency of 80 per cent., the efficiency of the steam pump being 60 per cent.

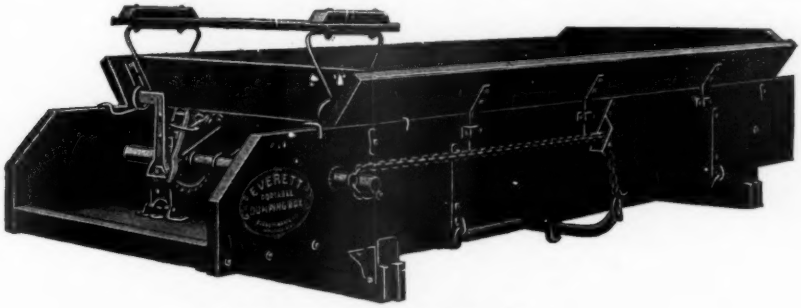
Catalog No. 6 of the Keystone Driller and Pump Co., Beaver Falls, Pa., can be had for the asking, and deals with pumps of the nature mentioned. The company also make Keystone cable drills for drilling deep wells.

An Efficient Portable Dumping Wagon Box.

The Everett portable dumping box is intended for any wagon having a reach and is made of widths required to fit wagons in general use and of any desired width on special order. It is strongly made, and braced with steel. The bottom is of four boards, two hung by "hook and eye" bearings from the sideboards of the box, and two hung from a steel tube running from end to end at the bottom of the box in the center. Thus the bottom can be quickly opened and the contents dumped on each side of the reach, without danger of damaging it. The bottom boards of the emptied wagon are lifted back to place by a steel truss running across the bed at the center, on which run rollers attached to castings bolted to the bottoms of the boards. This truss is lifted, for the purpose of closing the box, by means of chains at the two ends, which run up to rollers attached to the side of the box and thence to a steel tube running through the front end of the wagon in front of the front end board of the box. This tube is turned by a foot lever and winds up the chain by a three-quarters turn, enough to close the bottom boards tightly. Any slack in the chain is taken up by means of grab-links at the end of the chain, and the bottom can be set to open partly so as to give an opportunity to spread the load by driving along as the load runs out, by use of the same grab-links.

The foot lever locks automatically when the bottom is closed, so that the load cannot be dumped accidentally.

This dumping box has been in use by many contractors and engineers for a good many years and they say very enthusiastically that it has given satisfaction. They are in use on the Panama canal and the New York barge canal in large numbers, and by contractors in many cities and states throughout the country. The Everett Manufacturing Co., 84 Lake street, Newark, N. J., will send any further information desired.



THE EVERETT DUMPING BOX.

Trade Publications.

Circulars descriptive of the Eclipse concrete mixers, post, tile, brick and block machines have been received from Geo. C. Christopher & Son, Wichita, Kan.

Several circulars about the inventors' pocket library have been received from the Engineer Searching Co., of Washington.

One of the most recent publications of the National Association of Paving Brick Manufacturers, Indianapolis, Ind., is a handsomely illustrated booklet on "The Permanent Roadway," illustrating the construction of brick country roads.

A recent number of *The Concrete Review* of the Association of American Portland Cement Manufacturers contains a brief summary of the proceedings of the last meeting of the Association of German Portland Cement Manufacturers.

Booklet No. 38 of the Jeffrey Mfg. Co. is about Jeffrey conveying machinery.

The Barrett Mfg. Co. issues a booklet on good roads, how to build, preserve and make them dustless, which describes and illustrates the use and the results of the use of Tarvia "A," "B" and "X." It is a handsome book well worth the trouble of asking for it at the nearest office of the Barrett Mfg. Co.

The American Book Co., New York, sends an illustrated description of Halley's comet by Prof. David Todd, which also contains some sample pages of Todd's "Astronomy."

The accompanying illustration is a part of the cover-plate of a lucid little treatise

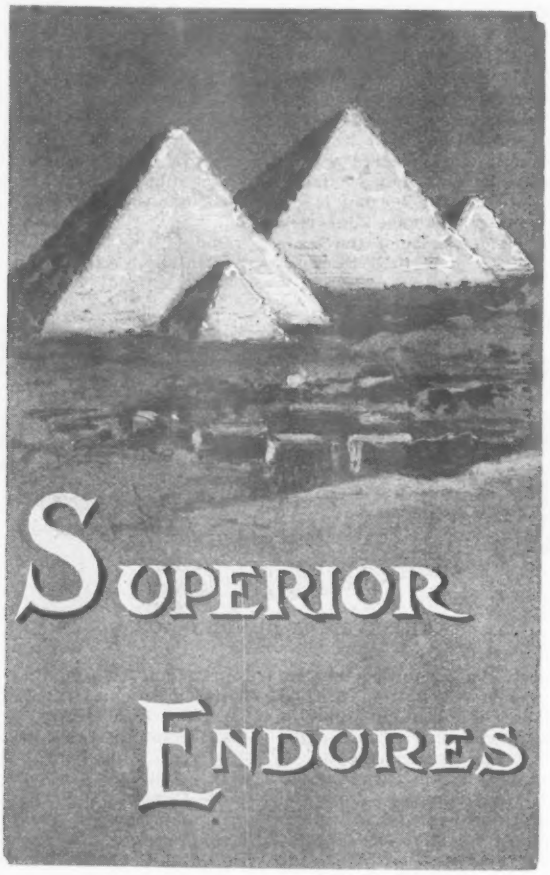
on Portland cement, just issued by The Portland Cement Co., Union Trust building, Cincinnati, Ohio, for free distribution among those interested in knowing how this cement is made, of what it is made, and why it will last for ages.

One of the best of the publications of the Indianapolis office of the Lehigh Portland Cement Company contains "Forty-One Reasons Why Concrete Should Be Selected to the Exclusion of Any Other Type of Construction," by DeWitt V. Moore, C. E., of the Moore-Mansfield Co., Indianapolis.

Bulletin No. 72, of the Universal Portland Cement Co., talks about concrete bungalows, concrete wall without forms, and some notable concrete buildings.

The San Antonio Sewer Pipe Co., San Antonio, Tex., sends a catalog of vitrified sewer pipe, well tubing, culvert and irrigation pipe, including a price list.

The Case steam road roller is well shown and is described in full detail of all its parts in the latest catalog of the road machinery department of the J. I. Case Threshing Machine Co., of Racine, Wis. The catalog also shows the Troy dump wagons, the Case sprinkling attachment on their tank engine tender, and a couple of Case traction engines.



INTRODUCES THE STORY OF SUPERIOR PORTLAND CEMENT.

Trade Notes.

ASPHALT.

St. Paul, Minn.—The purchase of a municipal asphalt paving plant is recommended by the mayor.

St. Joseph, Mo.—The Metropolitan Paving Co. has been incorporated by R. N. Davis, C. F. Enright and J. O. Fanleigh, and will engage in a general street paving business.

BRICK.

Mechanicsville, N. Y.—The Ferris Paving Brick Co. has changed its name to the Mechanicsville S. S. Brick Co.

Devil's Lake, N. D.—The plant of the Devil's Lake Petrified Brick and Stone Co. has been leased by Hans Westegaard, who will put it in condition to manufacture brick.

CEMENT.

Cedar Falls, Ia.—The C. A. Wise Sons Co. and Rolla Cheney, composing the Cedar Falls Cement Co., have dissolved

partnership, Mr. Cheney withdrawing from the firm.

CONCRETE BLOCKS.

Waterloo, Ia.—The Cement Products Co. has been organized, with H. S. Raymond as president; Howard A. Sharp, vice president; Ernest E. Schenk, secretary; W. H. Stewart, treasurer.

Onawa, Ia.—A. B. Elliott, proprietor of the Turin Cement Block and Tile Plant, has purchased the K. A. Pullen Cement Block Plant.

Mason City, Ia.—The Quimby Stone Co. has added a cement block plant to its business.

Grace Hill, Ia.—Bertle & Son have built a cement plant at Westchester, Ia., and are making cement blocks.

Three Forks, Mont.—The establishment of a second cement plant is proposed by D. A. Morrison.

Lone Tree, Ia.—J. R. Corbett contemplates establishing a cement block and tile plant.

Deadwood, S. D.—Hanson Bros. have established a cement block plant here.

Kensett, Ia.—The business men have under consideration the establishment of a cement core factory.

Knightstown, Ind.—The Knightstown Concrete Co. has been incorporated to manufacture concrete building blocks, by Harry Watts, W. L. Garritson and E. B. Byrket.

PURCHASE OF MACHINERY.

Indianapolis, Ind.—For Sale.—A complete contractor's up-to-date equipment; everything complete for street paving; also for grading and macadamizing county roads. Will sell as a whole or part. Address Box 408, care Municipal Engineering Co., Indianapolis.

Chicago, Ill.—Special.—The Humboldt Mfg. Co., mnfrs. of material testing apparatus, 2014 Nebraska ave., is in the market for Nos. 100 and 200 mesh standard wire gauze for testing cement according to the specifications of the American Society of Civil Engineers.

PURCHASE OF MATERIALS.

Wilmington, N. C.—Riprap Stone.—Bids are asked until June 14 for about 12,000 tons of riprap stone. Capt. Earl I. Brown, corps engrs.

Plymouth, Mass.—Riprap.—Bids are asked until June 6 for riprap stone in dike in Long Beach, Plymouth Harbor, Mass.

Cleveland, O.—Testing Materials.—Bids are asked until June 8 for testing materials for 1 year. Frank R. Lander, co. engr.

LIGHT, HEAT AND POWER.

Holdredge, Neb.—P. H. Cobb, of Funk, has obtained a patent on an acetylene gas lighting machine.

MISCELLANEOUS.

Lexington, Ky.—The Empire Bridge Co. has been incorporated by George Collins, Georgia E. Collins, Adelaine M. Hallett, James M. Young and E. F. Metcalfe, of Lexington.

IMPROVEMENT AND CONTRACTING NEWS

PAVING.

CONTEMPLATED WORK.

Pine Bluff, Ark.—Paving is urged for 5th ave.

Kenneth, Minn.—Cement sidewalks are contemplated.

Moose Lake, Minn.—Cement sidewalks are contemplated.

Moorhead, Minn.—This city voted to pave 1st ave. N.

Council Bluffs, Ia.—Paving is contemplated for 5th st.

Elmira, N. C.—Paving is contemplated for E. Union st.

Altoona, Pa.—Resurfacing is proposed for the paved streets.

Ft. Scott, Kans.—Paving is again being urged for S. Main st.

The Dalles, Ore.—The city council voted to pave with bitulithic.

Monroe, Ia.—Council has decided to pave B ave., W., and N. D st.

Normal, Ill.—Paving is contemplated for Ash st. and Virginia ave.

Manchester, Ia.—Cement paving is contemplated for Franklin st.

Hanly Falls, Minn.—A cement walk in 5th ave., W., is contemplated.

Manchester, Ia.—About 8 blocks of concrete paving are contemplated.

St. Charles, Minn.—Sidewalks in Winona and Church sts. are contemplated.

Rochester, Minn.—Council has been asked to pave Broadway and Main sts.

Ft. Dodge, Ia.—The construction of sidewalks in 18th st. is proposed.

Oskaloosa, Ia.—Council will take action June 6 on paving several streets.

Baraboo, Wis.—Macadam paving in Walnut and Maple sts. is contemplated.

Cooperstown, N. D.—The construction of concrete sidewalks is contemplated.

Kearney, N. J.—Davis st. will probably be paved with tarvia-coated telford.

Cherokee, Ia.—Paving is contemplated for the principal streets. Mayor Titus.

Utica, N. C.—Resolutions are pending for paving McQuode st. and Downer ave.

Highland Park, Mich.—This village voted to issue $89,000 for repaving Woodward ave.

Lestershire, N. Y.—The village bd. of trustees has decided to macadamize Main street.

Crystal Falls, Mich.—The estimated cost of paving Crystal ave. is $30,000 to $40,000.

Gadsden, Ala.—The construction of

sidewalks in various streets is contemplated.

Bedford, Ia.—Paving has been petitioned for in Washington and other streets.

Manchester, Ia.—Council will take action June 7 on paving and curbing Franklin st.

Marion, Ia.—Council will take action June 6 on paving small alleys with brick blocks.

Kalispell, Mont.—The city engineer will prepare plans for bituminous asphalt paving.

Albany, N. Y.—Paving is contemplated for Learned st., from N. Ferry to Thatcher st.

Davenport, Ia.—Plans have been prepared for paving Mound and other streets with brick.

Wellington, Kans.—Paving is contemplated for Lincoln ave., from Washington to Peek st.

Denison, Tex.—Gandy st., one of the leading residence streets, will probably be paved.

Houston, Tex.—Extensive paving is proposed for the roads in the vicinity of the Country Club.

Reading, Pa.—City Engineer Ulrich recommends repairs for the asphalt and brick streets.

Carmi, Ill.—Will vote June 4 on the issue of $8,000 bonds for constructing concrete sidewalks.

Roseburg, Ore.—Jackson and Main sts. will be paved with asphalt. A. N. Orcutt, cy. recdr.

New Cumberland, Pa.—The borough council has appropriated $20,000 for macadamizing streets.

Bloomfield, Ia.—A petition has been submitted to council asking that the public square be paved.

Springfield, O.—The property owners in Yellow Springs st. will petition for asphalt block paving.

Coeur d'Alene, Idaho.—This city will expend $20,000 on paving and other street improvements this year.

Pueblo, Colo.—The question of paving additional streets in the business district is being urged.

Lonsdale, Minn.—The village council contemplates the construction of cement sidewalks in Main st.

St. Cloud, Minn.—It is now proposed to pave 5th ave. with creosoted wood blocks instead of macadam.

Charleston, Ill.—The construction of 1½ mi. of pavement is contemplated. J. A. Tremble, cy. engr.

Savannah, Ga.—Ordinances are being prepared for paving Whitaker, Abercorn and Barnard sts. and Estill ave.

Williamsville, N. Y.—Paving is contemplated for Main st. Milton J. Hoffman, prest. bd. vil. trustees.

Clear Lake, Ia.—S. J. Clausen is chairman of a committee appointed to build an automobile road 20 mis. long.

St. Louis, Mo.—Paving is contemplated for Biddle, 13th, 7th, 8th, 10th and 11th sts., in the Ghetto dist.

Binghamton, N. Y.—The bd. of contract and supply decided, May 12, to pave Main and Front sts. with brick.

Chicago, Ill.—Creosoted wood block paving is contemplated for Clark, La Salle, Randolph and Washington sts.

Rochester, N. Y.—An ordinance has been passed providing for brick paving in Magnolia st. Mayor Edgerton.

Bellingham, Wash.—H. W. Troutman, cy. engr., will investigate bitu-mass paving in a number of eastern cities.

Springfield, Mo.—Plans are being formulated for paving Elm, Cherry, Walnut, St. Louis, Fremont, Kickapoo, Pickwick, Minor, Weller and other streets with Hassam and brick.

Dallas, Tex.—The property owners in Haskell ave., between Ross and McKinley, have petitioned for permanent paving.

Olympia, Wash.—Council has authorized the paving of Franklin st. and grading of Jefferson, Chestnut and other sts.

Taylor, Tex.—The city council has voted to accept the offer of the business men to pave Main st. with vitrified brick.

Minneapolis, Minn.—A resolution has been passed to construct curb and gutter in a number of streets. Henry N. Knott, cy. clk.

Rockford, Ill.—A petition is being circulated for paving Baker st., in Highland, from E. State st. to 2nd ave., with asphalt.

Marshalltown, Ia.—The property owners in the proposed brick paving district have now petitioned for concrete rather than brick.

Albany, N. Y.—An ordinance has been passed for paving Cherry st. from Franklin to Broadway. Frederick U. Bresler, clk. com. coun.

Indianapolis, Ind.—A resolution has been adopted to pave E. Washington st. from Audubon road to Sheridan ave. with wooden blocks.

Two Harbors, Minn.—Council voted to grade, macadamize and construct concrete and combination curb and gutters in Poplar and Cedar sts.

New Albany, Ind.—A preliminary resolution was adopted May 6 for paving W. Market st. with brick, asphalt, bitulithic or wooden blocks.

Pekin, Ill.—An ordinance has been passed to pave 3rd st. Place with brick on concrete. Estimates are being prepared for paving 2nd st.

Crookston, Minn.—The property owners are divided on the question of paving with asphalt or creosoted wood blocks. J. E. Carroll, cy. engr.

Pine Bluff, Ark.—The property owners in W. 5th ave. have decided upon asphalt or creosoted wood block paving over the present macadam pavement.

Indianapolis, Ind.—The property owners in certain streets have asked that bitumass be included in the paving specifications in this city.

Minneapolis, Minn.—Plans are being formulated for constructing a boulevard 150 ft. wide connecting this city and St. Paul with Lake Minnetonka.

Little Rock, Ark.—The petition and ordinance to pave Main st. with brick, asphalt or creosoted wood blocks have been adopted. Mayor Duley.

Dallas, Tex.—The question of paving San Jacinto st., from Akard st. to Washington ave., with bitulithic or sawed bois d'arc blocks is being considered.

Ft. Worth, Tex.—Paving is contemplated for all the unpaved crosss-town streets between Throckmorton and Commerce sts. Comr. Maddox, of sts. and public grounds.

Corning, Ia.—Special.—A resolution of necessity has been published for constructing 35,000 sq. yds. of brick paving. Theo. S. DeLay, cons. engr., Creston, Ia.

St. Cloud, Minn.—A petition is being circulated among the property owners in 5th ave., asking the city council to change the paving specifications from macadam to creosoted wood blocks.

Virginia, Minn.—Paving is contemplated as follows: Chestnut st. and part of Central ave., creosoted wood blocks; Maple st. and Central ave., creosoted wood blocks, bitulithic, granitoid, tar macadam and donellite.

Peoria, Ill.—Ordinances are pending for paving Meyers and California aves. with brick; resurfacing Perry ave. with asphalt; paving Walnut st. with brick. Estimates have been submitted of the cost of paving Adams st. with creosoted wood blocks.

CONTRACTS TO BE LET.

Medora, N. D.—Bids are asked until June 6 for road work. J. A. McGregor, co. audt.

Fowler, Ind.—Bids are asked until June 6 for constructing a road. Lemuel Shipman, co. audt.

Delphi, Ind.—Bids are asked until June 6 for constructing a gravel road. M. G. Haun, co. audt.

Greensburg, Ind.—Bids are asked until June 7 for constructing macadamized roads. Co. comrs.

Marion, Ind.—Bids are asked until June 7 for constructing a stone road. A. U. Stout, co. audt.

Brazil, Ind.—Bids are asked until June 6 for constructing a gravel road. Jas. L. Burns, co. audt.

Tipton, Ind.—Bids are asked until June 6 for constructing 6 gravel roads. J. F. Barlow, co. audt.

Madison, Ind.—Bids are asked until June 7 for constructing a gravel road. John Hoagland, supt.

Winamac, Ind.—Bids are asked until June 7 for constructing a road. Ellis S. Rees, co. audt.

Trenton, N. J.—Bids are asked until June 7 for macadamizing roads. Frank J. Epple, co. engr.

Richmond, Va.—Bids are asked until June 7 for constructing 4¼ mis. gravel road. Co. clk.

Perth Amboy, N. J.—Bids are asked until June 6 for grading Groom st. Geo. M. Adam, st. comr.

Augusta, Ky.—Bids are asked until June 1 for constructing 7,800 ft. of pike. J. T. McCracken.

Peru, Ind.—Bids are asked until June 8 for constructing 5 gravel roads. Chas. Griswold, co. audt.

Vernon, Ind.—Bids are asked until June 6 for constructing pike roads. T. L. Thomas, co. audt.

Vincennes, Ind.—Bids are asked until June 7 for constructing a gravel road. J. T. Scott, co. audt.

Crawfordsville, Ind.—Bids are asked until June 7 for improving a highway. Bennett B. Engle, co. audt.

Janesville, Wis.—Bids are asked until June 15 for paving Wisconsin and E sts. C. V. Kerch, cy. engr.

Greencastle, Ind.—Bids are asked until June 6 for constructing a macadam road. D. V. Moffett, co. audt.

Williamsport, Ind.—Bids are asked until June 6 for constructing gravel roads. Robt. L. Winks, co. audt.

Kentland, Ind.—Bids are asked until June 6 for constructing a macadam road. Elmer R. Bingham, co. audt.

Wabash, Ind.—Bids are asked until June 7 for constructing 6 gravel roads. J. P. Noftzger, co. audt.

Lafayette, Ind.—Bids are asked until June 11 for constructing a gravel road. John P. Forsman, co. audt.

Mt. Vernon, Ind.—Bids are asked until June 7 for constructing a gravel road. Paul Maier, co. audt.

Tipton, Ind.—Bids are asked until June 6 for constructing 6 gravel roads. J. F. Barlow, co. audt.

Virginia, Minn.—Bids are asked until about June 15 for paving various streets. E. F. Johnson, cy. engr.

Bloomfield, Ind.—Bids are asked until June 7 for constructing gravel roads. Peter M. Cook, co. audt.

English, Ind.—Bids are asked until June 6 for constructing improved roads. J. Evans Jones, co. audt.

Decatur, Ind.—Bids are asked until June 6 for constructing 4 macadam roads. H. S. Michaud, co. audt.

Washington, Ind.—Bids are asked until June 7 for constructing a gravel road. Thos. Nugent, co. audt.

Monticello, Ind.—Bids are asked until June 7 for constructing a stone road. A. G. Fisher, co. audt.

Bluffton, Ind.—Bids are asked until June 9 for constructing 4 gravel roads. O. D. Garrett, co. audt.

Muncie, Ind.—Bids are asked until June 8 for constructing a highway in Center twp. Jos. E. Davis, co. audt.

Wauseon, O.—Bids are asked until June 6 for grading, draining and placing stone on roads Nos. 70 and 71. Co. audt.

Cooperstown, N. D.—Bids are asked until June 6 for road grading in Bryan and Addie twps. R. M. Cowen, co. audt.

La Moure, N. D.—Bids are asked until June 6 for constructing sidewalks and street crossings. B. W. Loppinow, cy. audt.

Mt. Gilead, O.—Bids are asked until June 3 for constructing Westfield road impvt. No. 2. Clifton Sipe, co. audt.

Southport, Ind.—Bids are asked until June 6 for constructing cement sidewalks in Church st. A. L. Barnes, town clk.

Brazil, Ind.—Bids are asked until June 7 for constructing cement sidewalks in National ave. Jacob Prevett, cy. clk.

St. Paul, Minn.—Bids are asked until June 6 for improving White Bear and Lake Phalen roads. E. G. Krahmer, co. audt.

Hutchinson, Kans.—Bids are asked until June 3 for improving 3 roads, 8, 4 and 3 mis., respectively. A. R. Hamma, co. clk.

Upper Alton, Ill.—Bids will be asked about June 12 for paving Main and Garden sts. with vitrified brick. S. Crawford, mayor.

Rushville, Ind.—Bids are asked until June 7 for constructing brick streets in this city and suburbs. J. M. Stone, co. audt.

Valparaiso, Ind.—Bids are asked until June 7 for constructing a macadamized road in Porter and Liberty twps. S. P. Corboy, co. audt.

Cincinnati, O.—Bids are asked until June 3 for resurfacing Montgomery pike and oiling Harrison pike. Fred Dreihs, clk. co. comrs.

Kenmare, N. D.—Bids are asked until June 14 for constructing 2,700 ft. of roads and 2 culverts. Christ. Anderson, clk. town of Rockford.

Mishawaka, Ind.—Bids are asked until June 6 for 3,100 sq. yds. of brick paving between tracks in W. 2nd st. Jas. W. Haverly, cy. engr.

Eveleth, Minn.—Bids will be asked about July 1 for constructing cement sidewalks and curbing. D. B. Austin, cy. engr.; D. P. McIntyre, cy. clk.

Jackson, Miss.—Bids are asked until June 7 for constructing 39,000 sq. yds. of paving and 10,000 lin. ft. of curbing. B. H. Klyce, cy. engr.

Logansport, Ind.—Bids are asked until June 9 for constructing a gravel road in Cass and Carroll counties. Geo. W. Cann and M. S. Haron, co. audts.

Fort Sam Houston, Tex.—Bids are asked until June 9 for macadamizing roads, constructing concrete gutters, concrete walks, etc. P. W. Guiney, constr. Q. M.

Abilene, Kans.—Bids are asked until June 9 for 30,000 sq. yds. of paving, concrete curb and gutter, storm sewers and outlets. J. A. Graves, cy. clk.

Lebanon, Ind.—Bids are asked until June 6 for constructing a gravel road in Eagle twp. and brick paving through Zionsville. B. F. Herdrich, co. audt.

Princeton, W. Va.—Bids are asked until June 8 for constructing 3 mis. of macadam, tar or asphalt macadam, or bitulithic paving. F. R. Antwerp, ch. engr.

Indianapolis, Ind.—Bids are asked until June 3 for resurfacing and paving roadways and sidewalks in a number of streets. C. A. Schrader, prest. B. P. W.

Springfield, Ill.—Bids will be asked about June 6 for 20,822 sq. yds. of vitrified brick paving in 13th st., with sandstone curbing. Frank Hamilton, cy. engr.

Wabash, Ind.—Bids are asked until June 9 for constructing a highway on dividing line of Wabash and Huntington counties. John W. Weaver, audt. Huntington co.

Portland, Me.—Bids are asked until June 6 for improving the roadway at Eastern Parade. Jas. P. Jordan, chm. comrs. Cemeteries and Public Grounds, 410 Fore st.

Albany, N. Y.—Bids are asked until June 6 for the repair and resurfacing of a large number of highways. S. Percy Hooker, chm. State Highway Com., 53 Lancaster st.

Racine, Wis.—Bids are asked until June 4 for 3,000 sq. yds. of brick paving in Douglas ave. and 2 blocks of asphalt in Carlisle ave. P. H. Connelly, cy. engr.

Lucas, O.—Bids are asked until June 6 for 27,266 sq. yds. of paving, 7,520 lin. ft. curbing, 1,592 ft. 8, 10 and 12-in. sewer pipe. Geo. V. Raab, clk. vil. coun.

Dunkirk, N. Y.—Bids are asked until June 2 for constructing 19,000 sq. yds. of asphalt resurfacing in W. 4th st. and paving Swan and Fox sts. R. H. Heppell, cy. clk.

Billings, Mont.—Bids are asked until June 7 for constructing 32,040 sq. yds. of vitrified brick paving and 22,644 sq. yds. of creosoted wood block paving. J. D. Matheson, cy. clk.

Columbus, Ind.—Bids are asked until June 6 for 7,000 sq. yds. of brick, asphalt, bitulithic or creosoted wood block paving. Edwin A. Conn, cy. clk.; Wm. H. Rights, cy. engr.

New Hartford, N. Y.—Bids are asked until 4 p. m., June 1, for constructing 6,800 lin. ft. of combined concrete curb and gutter in Genesee st. A. B. Baker, prest. vil. bd. trustees.

Shelbyville, Ind.—Bids are asked until June 7 for grading and graveling a number of streets and alleys and for constructing cement sidewalks and curbs in several streets. L. E. Webb, cy. clk.

Albert Lea, Minn.—Bids are asked until June 7 for 12,423.86 sq. yds. of creosoted wood blocks, vitrified brick, mineral rubber or sandstone paving and 4,388 cu. yds. excavation in Main st. Wm. Barneck, cy. engr.

Wadesboro, N. C.—Bids are asked until June 3 for constructing 18,000 sq. yds. of 8 in. macadam, 2,500 lin. ft. combined concrete curb and gutter, 6,000 sq. yds. of cement sidewalk and 4,000 cu. yds. excavation. W. K. Boggan, mayor.

CONTRACTS AWARDED.

Schenectady, N. Y.—The contract for paving Willett st. was awarded to the Union Paving Co.

Duluth, Minn.—Diffon & Richie, of this city, secured the contract for repaving Hughitt ave.

Buffalo, N. Y.—The Barber Asphalt Paving Co. was awarded a contract, May 13, for paving Jefferson st.

Peoria, Ill.—John McAllister was awarded the contract for paving Garden st. with brick, for $30,195.76.

Dayton, O.—The contract for furnishing 8 carloads of asphalt was awarded to the California Asphalt Co.

Bellingham, Wash.—K. Sauset was awarded the contract for paving Chestnut st. with asphalt, for $28,704.

Penn Yan, N. Y.—The contract for paving Elm st. with brick was awarded, May 18, to C. N. Kelly, for $13,640.

Evansville, Ind.—The Western Construction Co. was awarded the contract for paving Powell ave. with asphalt.

Clinton, Okla.—The contract for sheet asphalt paving was awarded to the Heman Construction Co., of St. Louis.

Tacoma, Wash.—The Independent Asphalt Paving Co. was awarded the contract for paving Steele st., for $25,643.

Wenatchee, Wash.—Allen & McNerney secured the contract for 3,000 ft. of paving in Mission st., for $25,643.

Lafayette, Ind.—Daniel H. Fatout, of Indianapolis, was awarded a contract for constructing a gravel road, for $5,573.

Houston, Tex.—E. G. Smith was awarded the contract, May 14, for road work on the Lynchburg and Crosby road, for $22,200.

Houma, La.—The contract for constructing 1½ mis. of Schillinger pavement in Main st. was awarded to Garber & Maltby.

Pekin, Ill.—D. H. Jansen & Co. secured the contract for paving Washington st., May 7, at $1.69 a sq. yd., or $26,975.

Marion, Ind.—The contract for constructing the Grant Cole gravel road was awarded to Alexander & Crosby, of Bluffton, for $8,539.

Peoria, Ill.—J. W. Bushell was awarded a contract for paving 7th ave. and Hamilton and Jefferson sts. with asphalt, for $52,000.

San Jose, Cal.—Road contracts have been let as follows: John F. Adams, 6,705 ft., $8,779; John W. Wilson, 10,100 ft., $9,500.

Mt. Carmel, Pa.—The contract for paving was awarded to the Cowell Construction Co., of Williamsport, Pa., for $32,464.

Mt. Pleasant, Ia.—The contract for paving was awarded to the Burlington Construction Co., of Burlington, Ia., at $2.095 a sq. yd.

New Haven, Conn.—The contract for granite concrete paving was awarded to Field, Barker & Underwood, of Philadelphia, for $10,920.

Wheeling, W. Va.—The contract for paving the east side of Chapline st. was awarded to R. B. McCullough, at 37 cts. a sq. yd.

Evansville, Ind.—The Western Construction Co. was awarded a contract, May 11, for paving Main st. with asphalt, at $1.96 a sq. yd.

Kansas City, Mo.—The contract for 1,800 sq. yds. of bitulithic paving was awarded to the Kansas Bitulithic Co., 619 American Bank Bldg.

Amarillo, Tex.—The contract for the engineering and supervision of street paving and sewer extension was awarded to L. Dalton, of Dallas.

Centerville, Ia.—McGuire & Stanton, of Leavenworth, Kans., secured the contract, May 13, for 25,930 sq. yds. of brick paving, for $64,711.

Enola, Pa.—The contract for constructing granolithic sidewalks and paving was awarded to S. W. Shoemaker & Son, of Harrisburg, for $25,000.

Dallas, Tex.—(Special). The Texas Bitulithic Co., Praetorian Bldg., was awarded a contract for 5,780 sq. yds. of bitulithic paving.

Anderson, Ind.—Lawson & Kincade, of Indianapolis, secured the contract for paving Columbus ave., with No. 1 Indiana brick, for $23,000.

Mexico, Mo.—D. C. Owen was awarded the contract for paving E. Promenade st. with brick at $1.48 a sq. yd. and 38 cts. a lin. ft. for curbing.

Holdenville, Okla.—The contract for constructing 18 blocks of Oklahoma rock asphalt paving was awarded to the Shelley-Downard Co., of Ardmore.

St. Paul, Minn.—The contract for macadamizing Concord st. in South St. Paul, was awarded to Thorntown Bros., of this city, for $9,017.

Mishawaka, Ind.—The contract for paving Mill st. with bitulithic was awarded May 16 to the Western Construction Co., at $1.67 a sq. yd.

Highland Park, Ill.—The contract for repaving 27,000 ft. of Waverly ave. was awarded to the Schmidt Contracting Co., of Chicago, for $15,134.

Memphis, Tenn.—The Barber Asphalt Co. was awarded the contract, May 17, for paving Rayburn boulevard and McLemore ave. with asphalt, for $22,449.12 and $21,983.20, respectively.

Harlan, Ia.—The Lane Construction Co. was awarded the contract for paving, guttering and curbing the public square and 5th st. for $54,000.

Richmond, Cal.—The contract for paving 7th st. and Neoun ave. was awarded to Geo. A. Cushing, of Oakland, Cal., for $15,673 and $22,388, respectively.

Berkeley, Cal.—The Esterly Construction Co. was awarded the contract for 500,000 ft. of cement sidewalks to be laid in Northbrae, for about $50,000.

La Grande, Ore.—Special)—The Warren Construction Co., 317 Beck Bldg., Portland, secured the contract for 23,000 sq. yds. of bitulithic paving.

Mineola, L. I., N. Y.—The contract for macadamizing Conklin st., in Farmingdale, was awarded to Powers & Wheeler, of Oyster Bay, at 83 cts. a sq. yd.

Baker City, Ore.—(Special)—The contract for 30,000 sq. yds. of bitulithic paving was awarded to the Warren Construction Co., 317 Beck Bldg., Portland.

Little Falls, N. Y.—(Special)—Warren Bros. Co., 59 Temple Place, Boston, was awarded a contract for 3,830 sq. yds. of bitulithic paving in this city.

St. Joseph, Mo.—C. W. Dillingham was awarded a contract May 14 for paving 4th st., from Faraon to Isabelle, with Cuban asphalt, for $17,595.

Denver, Col.—Anderson, Ord & Swope, of Colorado Springs, secured the contract for grading and curbing 6½ mis. of Montclair boulevards, for $154,209.90.

El Paso, Tex.—(Special)—The contract for 3,349 sq. yds. bitulithic paving was awarded to the Texas Bitulithic Co., Praetorian Bldg., Dallas, Tex.

Richmond, Va.—The contract for paving the streets surrounding the John Marshall High School was awarded to I. J. Smith & Co., at $2.20 a sq. yd.

The Dalles, Ore.—(Special)—The contract for 18,000 sq. yds. of bitulithic paving was awarded to the Warren Construction Co., 317 Beck Bldg., Portland.

Cleveland, O.—The Enterprising Paving and Construction Co. was awarded a contract May 14 for paving Hebert Hill with Medina block stone, for $8,550.

Ft. Worth, Tex.—(Special)—The Texas Bitulithic Co., Praetorian Bldg., Dallas, secured the contract for 25,557 sq. yds. of bitulithic paving in this city.

St. Paul, Minn.—The contract for repaving Summit ave. with asphalt was awarded to the General Contracting Co., Temple Court, Minneapolis, for $53,940.

Enid, Okla.—The Warner-Quinlan Asphalt Co. was awarded the contract for paving Adams, Jefferson, Monroe, Cherokee, Washington and S. Grand sts., at $2.03 and $2.04 a sq. yd.

Galveston, Tex.—Kelso & Vautrin secured the contract for vitrified brick paving and combination cement curb and butter on all streets entering the seawall boulevard at right angles.

Norfolk, Va.—The Barber Asphalt Paving Co., Land Title Bldg., Philadelphia, was awarded the contract May 4 for paving 20,300 sq. yds. of streets in Greater Ghent, for $38,367.

Havre, Mont.—The contract for constructing cement walks in special impvt. districts Nos. 9, 10, 11, 12 and 13 was awarded to the Two Miracle Concrete Corporation of Minneapolis, for $8,500.

Louisville, Ky.—Contracts for vitrified block original street construction and aggregating $45,500, were awarded, May 9, to Henry Bickel Co. and the R. L. Figg Co., at $1.90 and $1.92 respectievely.

Raleigh, N. C.—The Peters Bros. Paving Co. was awarded the contract for paving Fayetteville and Martin sts. and like streets around the Capitol Square at $1.70 a sq. yd.

Dallas, Tex.—The contract for paving Patterson ave. with brick was awarded to J. C. Underwood, at $2.56 a sq. yd. Coffeyville brick on concrete, with asphalt filler, will be used.

Ft. Dodge, Ia.—The Bryant-Ford-McLaughlin Asphalt Paving Co. was awarded a contract for 70,000 sq. yds. of asphalt paving and 35,000 lin. ft. of curb and gutter, at $1.98 a sq. yd. or $175,000.

Superior, Wis.—Bids for paving Belknap st. were submitted as follows: Creosoted wood blocks, Kettle River Co., $67,179.48; brick, Ed. Johnson, $67,005.31; bitulithic, Warren Bros., $68,361.63.

Port Jervis, N. Y.—Mulerry Bros., of Albany, N. Y., secured the contract, May 11, for constructing about 11,000 sq. yds. of vitrified brick paving, in Pike and Front sts. and New Jersey ave., for $23,800.

Akron, O.—Contracts were awarded May 14 as follows: Reconstructing Mill st. with Medina stone, Wildes & Davidson, $22,289; Glenwood ave., Daniel O'Marr; W. Buchtel ave., brick and tar filler, McAllonan Bros., $5,664; Washington st., E. W. Shaffrey & Sons.

Chicago, Ill.—The American Asphalt Paving Co. was awarded contracts for resurfacing and paving portions of nine streets, April 29. The Ryan Paving Co. was awarded the contract for paving W. 43d st. with granite.

Portland, Ore.—(Special) — Contracts for bitulithic paving have been awarded as follows: 27,570 sq. yds., Warren Construction Co., 317 Beck Bldg., 5,912 sq. yds., Pacific Bridge Co., Mohawk Bldg.; 65,000 sq. yds., Pacific Bridge Co., Mohawk Bldg.; 40,000 sq. yds., Warren Construction Co., 317 Beck Bldg.

Newark, N. J.—The John F. Shanley Co., 36 Exchange Place, Jersey City, was awarded the contract for paving New and Hamilton sts. with bitulithic, for $11,231.

Grants Pass, Ore.—Special)—The Warren Construction Co., 317 Beck Bldg., Portland, secured the contract for 25,000 sq. yds. of bitulithic paving in this city.

Albert Lea, Minn.—The contract for constructing curbing in Main and Wash-

ington sts. was awarded May 17 to the Albert Lea Construction Co., for $4,620.

Duluth, Minn.—The contract for constructing macadam paving in Tower ave. was awarded to J. B. Palmer, for $6,212.50 and for Stinson ave. to E. Hawarden, for $950.

Niagara Falls, N. Y.—(Special)—The contract for 13,240 sq. yds. of bitulithic paving in 10th st. was awarded to Warren Bros. Co., 59 Temple Place, Boston, Mass.

St. Boniface, Man.—(Special)—The contract for 65,000 sq. yds. of bitulithic paving was awarded to the Bitulithic and Contracting Co., Ltd., Empers Block, Winnipeg, Man.

Elgin, Ill.—(Special)—Arwin E. Price was awarded the contract for 31,530 sq. yds. of bitulithic brick paving on 5 in. concrete base, for $59,279.47.

Cincinnati, O.—(Special)—Warren Bros. Co., 59 Temple Place, Boston, Mass., secured the contract for 42,150 sq. yds. of bitulithic paving in Clifton ave., this city.

Lewiston, Idaho.—(Special)—The contract for constructing 17,974 sq. yds. of bitulithic paving was awarded to the Warren Construction Co., 317 Beck Bldg., Portland, Ore.

Wichita, Kans.—(Special)—The contract for 11,906 sq. yds. of bitulithic paving was awarded to the Kansas Bitulithic Co., 619 American Bank Bldg., Kansas City.

Danville, Va.—(Special)—The Atlantic Bitulithic Co., 1126 Mutual Bldg., Richmond, Va., was awarded a contract for 28,566 sq. yds. of bitulithic paving in this city.

Roanoke, Va.—The contract for constructing a street under the railroad tracks at Lynchburg ave., Northwest Roanoke, was awarded to the Vaughn Construction Co., for $40,000.

Hartford, Conn.—Contracts for state road work were awarded May 17 to John De Michiel & Bros., of Torrington, Conn., Merritt & Bush, of Stamford, Conn., and F. Arigoni & Bro., of Durham.

Seattle, Wash.—Hans Pederson, Alaska Bldg., secured the contract for paving Western ave. et al. with granite paving and granite alley crossings, for $129,781.

New York City.—(Special)—The Standard Bitulithic Co., Hudson Terminal Bldg., secured the contract for 9,386 sq. yds. of bitulithic paving on Steubenville Pike, Allegheny Co., Pa.

St. Joseph, Mo.—The Metropolitan Paving Co. was awarded the contract May 21 for resurfacing Jule st. with brick at $1.48 a sq. yd. The Phoenix Brick and Construction Co. was awarded the contract for paving Anglique st. with brick, at $1.89 a sq. yd.

Rochester, N. Y.—Contracts for paving were awarded May 12 to Whitmore, Rauber & Vicinus, as follows: Tallniger alley, asphalt, $2,933.50; Mt. Hope st., asphalt and Medina block, $24,545; Oakland st., brick, $9,678.50; Federal st., brick, $18,567.

Leavenworth, Kans.—The contract for regrading and paving 6th, Chestnut, Vine, Charles, Pine and Middle sts. was awarded to O. C. Chapion, for $23,118.55; 4th and 2d sts., E. W. Gerger, $26,876.62; two alleys, Thos. Jones & Son, $1,917.58.

Mishawaka, Ind.—Bids for paving Mill st., were submitted as follows: W. H. Bell & Co., asphalt, $2.75 a sq. yd.; brick, $1.75; Western Construction Co., Trinidad Lake asphalt, $1.69, bitulithic, $1.67; Rankert & Eggleston, brick, $1.60; Stevenson Construction Co., of Chicago, asphalt $1.85, brick $1.65; Peters Bros. Paving Co., Obispo asphalt, $1.70.

Utica, N. Y.—New bids were submitted May 11 for paving 12 streets, the Barber Asphalt Paving Co. bidding $1.79, John R. Lee $1.85, and the Warner-Quinlan Asphalt Co., $1.86 a sq. yd. Bids were received April 20 on the same work, the respective companies bidding $1.91, $1.85 and $1.96 a sq. yd.

Louisville, Ky.—Contracts for constructing granitoid pavements were awarded, May 17, as follows: Brook, Jackson, Courtney and Greenwood sts., Marion County Construction Co., $29,000; Windsor Place, Willow ave., Bailey, Galt and Peterson sts., Barber Asphalt Paving Co., $40,000.

Louisville, Ky.—Contracts for granitoid paving were let May 16, as follows: Brook, Jackson, Courtney and Greenwood sts., Marion County Construction Co., $1.85 a sq. yd. or $29,000; Windsor Place, Willow ave., Bailey, Galt and Peterson sts., Barber Asphalt Paving Co., $1.97 a sq. yd., or $40,000.

Los Angeles, Cal.—The contract for asphalt paving in Wall st. was awarded to the Fairchild-Gilmore-Wilton Co. for $20,226. The Mesa Land Co. awarded a contract to J. A. Merrill for grading, oiling and constructing cement curb and sidewalks on 80 acres of the Angeles Mesa Tract, for $38,696; additional work to be done at the following rate, 23 cts. per lin. ft. for cement curbs, 8½ cts. per sq. ft. for cement walks, 11 cts. per sq. ft. for oiled streets and gutters, 18 cts. per cu. yd. for grading and moving dirt.

New York City.—Bids for paving have been submitted as follows: Richmond Boro, May 10, regulating and repaving on a concrete foundation with medina sand stone block pavement the roadway of Richmond ave., from Post ave. to Blackford ave., Thomas F. Carlin, Port Richmond, S. I., $19,670; Joseph Johnsons' Sons, Brooklyn, $21,643; W. J. Quinlen, Brooklyn, $19,835; Londine & Gallo, Brooklyn, $20,555; John E. Donovan, Brooklyn, $20,712.

Buffalo, N. Y.—Contracts have been awarded as follows: Repaving Pratt st. from Broadway to Genesee, to Henry P. Burgard & Co., $13,000; Woodlawn ave., from Main to Jefferson, Barber Asphalt Co., $19,000; Normal ave., from Vermont to Massachusetts, German Rock Asphalt and Cement Co., $7,087; Tenth st., from Virginia to Maryland, German Rock Asphalt and Cement Co., $3,940.

Buffalo, N. Y.—Bids were submitted, May 18, for paving Bryant st., as follows: Barber Asphalt Paving Co., asphalt, $7,290; Michigan st., German Rock Asphalt and Cement Co., asphalt, $15,830; Krettner st., German Rock Asphalt and Cement Co., asphalt, $10,870; Grey st., Genesee to High, Henry P. Burgard, asphalt, $4,950; alley off Cherry st., Barber Asphalt Paving Co., asphalt, $2,013.

St. Louis, Mo.—Contracts for paving 16 streets with asphalt, and reconstructing Washington ave. and Chestnut sts with wood blocks have been awarded as follows: Laurel, from Ridge ave. to Wells, the Parker Washington Co., $3,921.25 Holly, from Penrose to Carter, same, $7,351.30; Penrose, from Grand to Prairie, Skrainka Construction Co., $9,694.10; Taylor, from Ashland to Margaretta, same, $14,694.63; Gravois, from Arsenal to Grand, G. Evermann & Bro., $39,943.66; Coleman, from Montgomery to Garrison, same, $2,662.20; Walnut, from Tenth to Twelfth, Frederick Ruecking, $8,439.50; Adelaide, from Florissant to Rosalie, Granite Bituminous Paving Co., $8,205.56; King's Highway, from Gravois to Nottingham, G. A. Heman, $61,321.30; King's Highway, from Nottingham to Arsenal, same, $53,419; Washington, from Fourth

to Twelfth, the Parker Washington Co., $29,737.28; Fourth, from Chestnut to Washington, same, $14,549.52; Washington, from King's Highway to Union, same, $33,694.38; Rauschenbach, from Benton to Hebert, William H. Redemeyer, $17,-172.30; Palm, from Broadway to Fourteenth, same, $13,308.48.

Brooklyn Boro, May 17.—Grading, curbing and constructing sidewalks in Haseman ave., Moran-Crowley Co., $31,123; Walter L. Cassell, 2627 Bedford ave., Brooklyn, $27,026; Leo E. Kelley, $34,-242; S. Purificato, 449 East 116th st., New York, $25,592; Newman & Carey Co., $29,641. For regulating and paving with asphalt pavement on a concrete foundation the roadway of Seventh ave., from 43d st. to 49th st.: Uvalde Asphalt Paving Co., 1 Broadway, New York, $11,926; Cranford Co., $12,358; Barber Asphalt Paving Co., 30 Church st., New York, $12,580; Brooklyn Alcatraz Asphalt Co., 407 Hamilton ave., Brooklyn, $11,664. For regulating and paving with asphalt pavement on a concrete foundation the roadway of 72d st., between Second ave. and the Shore Road, with the exception of strip 12 ft. in width in the center of the roadway, from First ave. to a point about 338 ft. easterly, to be paved with granite block on a concrete foundation: Uvalde Asphalt Paving Co., 1 Broadway, New York, $12,569; Cranford Co., Brooklyn, $13,568; Barber Asphalt Paving Co., 30 Church st., New York, $14,-129; Brooklyn Alcatraz Asphalt Co., 407 Hamilton ave., Brooklyn, $12,368. For regulating and paving with asphalt pavement on a concrete foundation the roadway of Sutter ave., from Van Sicien ave. to Berriman st.: Uvalde Asphalt Paving Co., 1 Broadway, New York, $16,577; Cranford Co., Brooklyn, $17,556; Barber Asphalt Paving Co., New York, $19,034; Borough Asphalt Co., $16,184.

SEWERS.

CONTEMPLATED WORK.

Bryan, Tex.—A sewerage system is contemplated.

Plano, Tex.—A sewerage system is contemplated.

Mondovi, Wis.—A sewer in Franklin st. is contemplated.

Tulare, Cal.—Plans for a sewerage system have been accepted.

Burch, Colo.—The town board has decided to construct a sewerage system.

Waupaca, Wis.—Bonds will be issued for constructing a septic tank and sewer.

Thief River Falls, Minn.—Council has decided to establish 3 new sewer systems.

Macon, Ga.—Bids will be asked soon for constructing the Vineville sewer system.

Huntington, W. Va.—This city voted to issue $125,000 bonds for constructing sewers.

Grandville, Idaho.—Will vote on issue of $50,000 bonds for sewer purposes June 6.

St. Charles, Ill.—Plans have been completed for a sanitary sewer system. F. B. Hunt, mayor.

Davenport, Wash.—The city council has authorized temporary plans for a sewerage system.

Carrollton, Mo.—The construction of lateral sewers is contemplated. J. F. Graham, mayor.

Hailey, Idaho.—The estimated cost of constructing a sewerage system is $40,-839.09.

Oroville, Cal.—Plans will be prepared for constructing a sewerage system. E. J. Mitchell, cy. clk.

Quincy, Ill.—The special committee will report on the proposed North End sewer at the June meeting.

La Grande, Ore.—Louis C. Kelsey has been engaged as consulting engineer on the proposed sewerage system.

Iowa Falls, Ia.—Plans are being prepared for 7 blocks of vitrified tile sewer. F. Truman, cy. engr.

Topeka, Kans.—Plans are being prepared for constructing a new sewerage system in the western part of the city.

Madison, Wis.—Cy. engr. Icke estimates the cost of constructing a new sewage disposal plant at $183,000.

San Antonio, Tex.—The council committee on sewers has recommended the construction of a number of sewers.

Irvington, N. J.—An ordinance has been passed to construct a sanitary sewer in 16th ave. W. L. Glorieux, mayor.

Charlottesville, Va.—This city contemplates constructing about 15,000 ft of sewer. E. T. Caruthers, cy. clk.

Bremen, Ind.—This city contemplates installing 8 blocks of vitrified clay tile sewer. T. S. Knoblock, cy. clk.

Gas City, Ind.—A committee has been appointed to investigate the advisability of constructing a trunk sewer line.

Franklin, Ind.—Plans are being prepared for the installation of a sewer 4 blocks in length. Thos. Moore, cy. clk.

Monroe, Wis.—Paul Hodges, cy. engr., is preparing plans for 14 blocks of gravity sewer. Christ Roth, cy. clk.

Warrensburg, Mo.—Plans are being prepared for a district sanitary sewer and septic tank. W. H. Sanders, cy. engr.

Jackson, O.—Plans have been completed for a reinforced concrete sewage disposal plant. Walter Rideneur, vil. clk.

Mason City, Ia.—Plans have been completed for 6 blocks of vitrified tile sewer in 6th and 10th sts. J. H. McEwen, cy. clk.

Sheboygan, Wis.—Plans have been completed for an intercepting sewer from Michigan ave. and N. 3d st. to the river.

Broken Bow, Neb.—Plans for a sewerage system will be prepared by the W. K. Palmer Co., Dwight Bldg., Kansas City, Mo.

Little Rock, Ark.—Plans have been formulated for constructing a sewer in the 8th ward. E. A. Kingsley, supt. pub. wks.

Los Gatos, Cal.—Plans and specifications have been adopted for constructing a sewer in San Jose ave. Bd. town trustees.

Waverly, Ia.—Council will consider a resolution, June 20, for constructing an 8 in. vitrified sewer in Fremont st.

Knoxville, Ia.—Council will take action June 15 on a resolution to construct a 10-in. vitrified pipe sewer in 4th st.

Elkhart, Ind.—A resolution has been adopted and a hearing will be held June 6 for constructing a sewer in E. Jackson st.

Spokane, Wash.—Plans have been approved for constructing a sewer system in the 4th and 5th wards. Cy. engr. Mccartney.

Dubuque, Ia.—Bids will be asked for soon for reconstructing concrete storm sewers in Cooler creek. C. H. Baumgartner, cy. engr.

Litchfield, Ill.—Plans have been prepared for constructing 8 blocks of vitrified tile sewer. A. Stropelin, secy. bd. local impvts.

Springfield, Mo.—A new district has been established in the northwestern section of the city, to be 3,000 ft. long. Plans

for a septic tank will be prepared by Harry G. Norton, cy. Engr., to be located at mouth of city sewer on the south side.

Guymon, Okla.—A petition is being circulated asking for an election to vote on the question of constructing a sewerage system.

Peru, Ind.—The construction of 1,200 ft. of 12 in. clay tile sewer in 9th st. is contemplated. Michael Horan, cy. engr.

Spencer, Ia.—Council will consider a resolution June 17 for the construction of an 8 in. salt-glazed vitrified pipe sewer in 6th st.

Albert Lea, Minn.—(Special)—Wm. Barneck, cy. engr., says plans are being prepared for an extension system of sewers, and bids will soon be asked.

Holland, Mich.—Plans are being prepared for crock tile sewers to be installed in 21st, 22d, 23d and 24th sts. H. A. Neberhaus, cy. engr.

Birmingham, Ala.—Maury Nicholson, cy engr., has completed plans and specifications for installing a storm drainage system for the Northlands.

Tullahoma, Tenn. — (Special) — Doak Aydelott, secy. Highlands Co. says summer and winter resort is being established and sewerage will be needed.

Cadillac, Mich.—Bids will be asked about June 1 for constructing a crock tile sewer. Plans are being prepared for 2 sewage disposal plants and bids will be asked about June 1. R. E. Elsner, cy. engr.

Yoakum, Tex.—Aldermen Shall and Maresh and J. M. Haller, J. Lyons, W. L. Johnston, W. T. Brain and Philip Welhausen have been appointed a committee to confer with the citizens as to the best plan for constructing a sewerage system.

Fitchburg, Mass.—The governor has signed the sewer bill which provides for the appointment of a sewer committee by the mayor, to have charge of constructing a sewage disposal system, drains and sewers.

New Orleans, La.—Major B. M. Harrod and Rudolph Hering, of the advisory board of engineers, who have been working with Engineers Earl, Kirkland, Raymond and Wood of the sewerage and water board, on plans for the economical completion of the water and drainage systems, have reported to the sewerage and water bd.

Visalia, Cal.—(Special)—Marve L. Weaver, cy. engr., advises us that municipal bonds for $95,500 were sold, May 18, and contracts for the work will be let as soon as possible thereafter. The greater part of the work will consist of the construction of about 860 lin. ft. of reinforced concrete conduit, and 2,040 lin. ft. of conduit of lighter construction.

CONTRACTS TO BE LET.

Vancouver, Wash.—Bids are asked until June 15 for constructing "B" st. lateral. Cy. clk.

St. Louis, Mo.—Bids are asked until June 21 for constructing River des Peres foul water sewer. B. P. I.

Forest City, Ia.—Bids are asked until June 7 for constructing tile work in drainage dist. No. 9. L. J. Nelson, co. audt.

Appleton, Wis.—Bids are asked until June 3 for constructing a concrete sewer in the 5th ward. C. H. Vinol, cy. engr.

Abilene, Kans.—Bids are asked until June 9 for constructing storm sewers, storm sewer outlets, etc. A. W. Rice, mayor.

Hot Springs, S. D.—Bids are asked until June 6 for constructing a lateral sewer in dist. No. 2. L. H. Herdrick, cy. audt.

Fort Missoula, Mont.—Bids are asked until June 6 for constructing a sewerage system. Major A. B. Shattuck, constr. Q. M.

Greenfield, Ind.—Bids are asked until June 7 for constructing a drain. G. W. Allen, drainage comr.

Regina, Sask.—Bids are asked until June 6 for constructing sewage disposal works. A. E. Chivers, cy. clk.

Princeton, W. Va.—Bids are asked until June 8 for constructing sanitary sewers. F. B. Antwerp, ch. engr.

Tallahassee, Fla.—Bids are asked until June 15 for excavating 5 drainage canals in the Everglades. J. O .Wright, ch. drainage engr.

Monticello, Ark.—Bids are asked until Aug. 3 for constructing about 7 mis. of 8 to 12 in. pipe sewers. Walter G. Kirkpatrick, engr., Jackson, Miss.

Ft. Sill, Okla.—Bids are asked until June 10 for constructing a sewage purification plant and reservoir. Capt. David L. Stone, constr. Q. M.

Council Bluffs, Ia.—Bids are asked until June 9 for constructing a drainage ditch along the course of Pigeon creek in Neola. R. V. Innes, co. audt.

St. Louis, Mo.—Bids are asked until June 7 for reconstructing concrete sewers in North Harlem districts Nos. 1 and 2. H. R. Fardwell, sewer comr.

Ft. Williams (Cape College, P. O.), Ore. —Bids are asked until June 4 for additions to the sewer system. Capt. C. F. Humphrey, Jr., constr. Q. M.

Havelock, Neb.—Bids are asked until June 7 for constructing a sewerage system with 41 manholes and reinforced concrete outlet. C. A. Currie, cy. clk.

York, Pa.—Bids are asked until June 6 for constructing sewers in Carlisle and Madison aves. and S. Queen and Manchester sts. Harry Washers, chm. B. P. W.

Belton, Tex.—Bids are asked until June 14 for constructing sanitary sewers and a sewage purification plant. J. M. Frazier, prest. Belton Sanitary Sewer Co.

Sandusky, O.—Bids are asked until June 8 for reconstructing and enlarging the lateral sewer in Washington, Hancock, Franklin and Warren sts. John Big, dir. B. P. S.

Chattanooga, Tenn.—Bids are asked until June 7 for constructing a sewerage pumping station, furnishing and installing two centrifugal pumps, electric motors, etc. H. F. Van Dusen, chm. B. P. W.

Plainfield, N. J.—Bids are asked until June 6 for constructing 4,210 ft. 8 in. vitrified pipe sewer; 11 manholes; 2 flush manholes; 150 branches; 440 ft. 4 in. vitrified pipe house connections. James MacMurray, cy. clk.

CONTRACTS AWARDED.

Rockford, Ill.—G. Maffioli was awarded a contract for constructing a sewer.

St. Petersburg, Fla.—The contract for constructing sewer No. 12 was awarded, May 6, to Overman & Hoxie.

Cincinnati, O.—The contract for constructing the Boldface sewer was awarded to McCarthy Bros., for $113,791.

Lexington, Ky.—The contract for constructing a sanitary sewer in W. Short ave. was awarded to Joseph Melvin & Co.

Moose Jaw, Sask.—Patrick Kilonny was awarded a contract for constructing 7,100 ft of sewer pipe, for $9,822.

Oshkosh, Wis.—The contract for constructing 5,585 ft. of tile sewers was awarded to J. Rasmussen & Sons Co.

Altoona, Pa.—The contracts for constructing sewer in various sections of the

city were awarded May 6 to J. P. Harney & Co., and J. L. Wilson.

Fultonville, N. Y.—The contract for constructing sewers was awarded to M. F. Dollard, of Albany, for $16,000.

Wenatchee, Wash.—The contract for constructing 6 mls. of sewer was awarded to Wetsel & Foster, of Spokane, for $227,-080.

Richmond, Ind.—Maynard & Ford secured the contract for constructing a trunk sewer for Bacon's Quarter branch to Shepherd st.

Colfax, Ia.—The contract for constructing sewers was awarded to the J. W. Turner Impvt. Co., of Des Moines, for $9,400.

Manhattan, Kans.—W. W. Cook & Son, of Junction City, was awarded the contract for constructing sanitary sewer for $88,124.

Morrillton, Ark.—The contract for constructing a sewerage system was awarded to J. M. McCoppin, of Little Rock, for $15,000.

Madill, Okla.—The Tonkawa Construction Co. submitted the lowest bid, May 9, for constructing a sewerage system, at $16,051.

Madill, Okla.—The Tonkawa Construction Co. submitted the lowest bid, May 9, for constructing a sewerage system at $16,051.

Richmond, Cal.—Sewer contracts have been awarded as follows: 7th st., George W. Cushing, $15,083; Santa Fe dist., Wm. Heafey, $3,102.

Leavenworth, Kans.—The contract for constructing the main sewer and laterals was awarded to McGurrie & Stanton, for $34,954.

Montreal, Que.—The contract for constructing the last section of the Sherbrooke st. sewer was awarded to M. Dineen, for $37,072.

Woodward, Okla.—The American Light and Water Co., of Kansas City, was awarded the contract for constructing a sewerage system for $63,940.

Hays City, Kans.—The Midland Construction Co., Ft. Scott, Kans., was awarded the contract for constructing sanitary sewers, for $28,109.

Stutgart, Ark.—The contract for constructing a sewerage system was awarded to the Kress Construction Co., of Oklahoma City, for $17,130.80.

Bridgeburg, Ont.—John F. Connolly, of Toronto, was awarded the contract for constructing 10,000 lin. ft. of pipe sewers, a septic tank, etc.

Missouri Valley, Ia.—The contract for constructing a system of sewers was awarded to the Omaha Construction Co., of Omaha, Neb., as follows: 84 ft. 18-in. c. i. pipe, $4; 200 ft. 12-in., $2.25; 4,704 ft. 18-in., $1.03; 390 ft. 15-in., 77 cts.; 2,770 ft. 12-in., 57 cts; 7,774 ft. 10-in., 54 cts., and 17,534 ft. 8-in., 46 cts; 64 manholes, each $35; a bulkhead, $100, and 1,000 ft. ¾-in. galv. pipe, 25 cts.; total, $24,184.

Hays, Kans.—The contract for constructing a sewerage system was awarded to the Midland Construction Co., of Ft. Scott, Kans., for about $60,000.

Jackson, Tenn.—The contract for constructing sewers in Southeast Jackson was awarded May 10 to the Newman Sewerage Co., of Evansville, Ind., for $26,-276.63.

Milwaukee, Wis.—The contract for constructing a sewer from Milwaukee and Detroit sts. to 11th ave. and Scott st. was awarded to R. J. Hickey, for $23,657.78.

Atlanta, Ga.—Sewer contracts have been awarded as follows: Lloyd st. relief sewer, 1½ mi., C. W. Lane Construction Co., $80,116; sewer in Woodward and Summit aves., Simpson and other streets, B. F. Weeks Construction and Equipment Co., $28,887.37.

Elgin, Ill.—(Special)—C. E. Plum, cy. engr., says the contract for constructing a sewer in Locust st., was awarded to Lorenson, Teteers & Joragensen, of this city.

Comstock, N. Y.—The contract for constructing a sewage disposal plant at the Great Meadow prison here was awarded to the Hudson Valley Construction Co., 30 4th st., Troy.

Springfield, Ill.—The contract for constructing sewers in 17th st. and two sections of Edwards st. was awarded to Henry Nelch & Son, at $1.25, 80 cts. and $1.10, respectively.

Baltimore, Md.—The contract for constructing the Jones' Falls intercepter, sec. No. 2, was awarded, May 11, to the United Engineering and Construction Co., of Baltimore, for $83,835.

Alliance, Neb.—The contract for constructing laterals in sewer dist. Nos. 15, 17, 18, 21, 22, 23, 26 and 33 was awarded to G. A. Dunlap, of the Inter-Mountain Bridge and Construction Co.

Atchison, Kans.—Williams & Sample have been awarded a contract for constructing a sewer in District "N," at the following bid: Plain concrete, $4,757; reinforced concrete, $44,655; lock joint, $44,910.

Angleton, Tex.—J. C. Kelso, of Galveston, was awarded the contract for constructing the Alvin drainage, at 10½ cts. a cu. yd. for dry drainage, 16½ cts. for wet, and $300 a mi. for clearing timber from the right of way.

Lorain, O.—The contract for constructing a pipe sewer was awarded to H. J. Bayter, 622 22d st., for $8,236. The Ohio Engineering Co., Elyria, secured the contract for 1,800 ft. of 48 and 36-in. concrete pipe sewer, for $9,926.

Memphis, Tenn.—The contract for constructing sewers in Klondike was awarded to the Pouncey Paving & Construction Co., of Helena, Ark., for $6,071.50. Abernthy & Garvin secured the contract for sewers in Mt. Arlington, for $6,642.57½.

WATER WORKS.

CONTEMPLATED WORK.

Hood River, Ore.—A water works system is contemplated.

Bandon, Ore.—A water works system is contemplated.

Fernie, B. C.—Voted to install a water works system.

Bangor, Me.—A new filtration plant is contemplated.

Sparta, Ga.—Voted to issue $40,000 bonds for water works.

Cairo, Ga.—Voted to issue bonds for water works extensions.

Dunkirk, O.—Voted to construct a water works system.

Orchard, Neb.—The construction of a water works system is contemplated.

Alice, via Hibbing, Minn.—A water works system is contemplated.

Onida, S. D.—Will vote on the installation of a water works system.

Beaver Dam, Wis.—The extension of the water mains has been petitioned for.

Baraboo, Wis.—Council is considering a petition to extend the water mains.

Rippey, Ia.—Voted to issue bonds for building and equipping a water works system.

New Decatur, Ala.—The Decatur Wa-

ter Works Co. contemplates installing a filter plant.

Black Diamond, Cal.—A municipal water works and electric light plant is contemplated.

Saginaw, Mich.—Will vote June 28 on the question of constructing a water works system.

Belle Fourche, S. D.—The construction of a water works system has been decided upon.

Eveleth, Minn.—The superintendent of water works has recommended the purchase of a pump.

Cottage Grove, Ore.—Bids will be asked soon for constructing a gravity water works system.

Paxton, Ill.—An ordinance has been passed to construct a 4 in. c. i. water main in W. Franklin st.

Alvin, Tex.—Voted to issue $4,000 water works bonds for improvements to the water works system.

Gaffney, S. C.—This city will expend $125,000 for water works and sewerage construction.

Mansfield, O.—A 12-in. water pipe line contemplated.

Dalton, Ga.—Voted to issue bonds for improvements and extensions to the water works system.

Canal Dover, O.—Bids will be asked soon for water-works extensions. Geo. W. Arnold, cy. engr.

Williamston, S. C.—This city will expend $20,000 for water works and sewerage systems. E. C. Horton.

Chisholm, Minn.—Improvement to the water works system is contemplated at a cost of about $40,000.

Sylvania, Ga.—Voted to issue bonds for constructing water works, electric light and sewerage systems.

Sacramento, Cal.—Mayor M. R. Beard recommends the purchase of a pump. M. J. Desmond, cy. clk.

Austin, Minn.—Bids will be asked soon for additions to the water works system. M. B. Clausen, cy. engr.

Woburn, Mass.—This city contemplates expending $20,000 this year for new water mains. Wm. B. Jones, mayor.

Boonville, Mo.—Will ask for bids in June for constructing a concrete reservoir. S. W. Reymill, cy. engr.

Donaldsonville, Ga.—Voted to issue bonds for improving the water works system and installing an electric light plant.

East Dundee, Ill.—The extension of the water mains and water works improvements are contemplated. L. R. Barrett, prest. vil.

Minneapolis, Minn.—A resolution has been passed for constructing c. i. water mains, hydrants, gates, etc. John H. Van Nest, prest. coun.

Portland, Ore.—The city auditor has been directed to ask for bids for constructing a new submerged pipe line across the Williamette river.

Imperial, Cal.—The city trustees contemplate a pipe line from the Brawley main canal to the city reservoirs for the new municipal water supply.

Nottingham, O.—Voted to issue $15,000 bonds for extending the water mains throughout that portion of the village not now supplied by the water system.

Mount Joy, Pa.—Council has decided to purchase 1,200 ft. of 4 in. pipe for the extension of the water mains in David st. and Lombard and Detweiler aves.

Conway, Ark.—Dickinson & Watkins, Southern Trust Bldg., Little Rock, have been appointed engineers for the proposed water works system. C. W. A. Wilson, secy. water bd.

Danville, Ill.—(Special)—Frank Yayne, C. E., Adams Bldg., advises us that he desires to purchase a direct-connected, automatic centrifugal pump.

Bryan, Tex.—Mayor Maloney and Aldermen Henderson and Edge have been appointed a committee to confer with Prof. J. C. Nagle, the recently elected city engineer, relative to plans for waterworks, light and sewerage systems.

CONTRACTS TO BE LET.

Athens, Tex.—Bids are asked until June 8 for constructing a water works system.

Ft. Logan H. Roots, Ark.—Bids are asked until June 6 for constructing a steel tank. Constr. Q. M.

Milford, Neb.—Bids are asked until about July 1 for constructing a water works and electric light plant.

Huntsville, Mo.—Bids are asked until June 14 for constructing a water works system. J. B. Holman, cy. clk.

Portsmouth, Ia.—Bids are asked until June 6 for constructing a steel stand pipe. Peter Harkenmath, mayor.

Havelock, Neb.—Bids are asked until June 7 for constructing water works extensions. C. A. Curie, cy. clk.

Waterbury, Conn.—Bids are asked until June 7 for constructing a storage reservoir dam. R. A. Cairns, cy. engr.

Blackduck, Minn.—Bids are asked until 8 p. m. June 2 for 1 fire underwriters' pump. D. D. Rolfe, vil, recdr.

Eldora, Ia.—Bids are asked until June 6 for furnishing 2,000 ft. 4-in. c. i. pipe. Stephen Sayer, chm. purchasing com.

Dayton, Ky.—Bids are asked until June 20 for a water works franchise for a period of 20 years. W. C. Martin, cy. clk.

Jacksonville, Fla.—Bids are asked until June 6 for constructing a covered reinforced concrete reservoir. F. R. Mowe, engr.

Corydon, Ia.—Bids are asked until June 6 for drilling an artesian well. J. J. C. Bower, town clk.; Iowa Engrg. Co., engrs.

Marshall, Minn.—Bids are asked until June 3 for digging a soft water well at the court house. Ernest S. Shepard, co. audt.

Cleveland Heights, O.—Bids are asked until June 14 for constructing a 6-in. water main in Maple road. H. H. Canfield, vil. clk.

Ft. Missoula, Mont.—Bids are asked until June 6 for constructing a water distributing system. Major A. B. Shattuck, Constr. Q. M.

Danville, Ill.—Bids are asked until June 3 for constructing a concrete dam and other water works improvements. Danville Water Co.

Rahway, N. J.—Bids are asked until June 9 for constructing 1 or more driven wells. Decatur M. Saywer, prest. N. J. Reformatory.

Boise, Idaho.—Bids are asked until July 8 for the enlargement of the main south side canal. Payette-Boise irrigation project, Reclamation Service, Boise.

Lewiston, Idaho.—Bids are asked until June 6 for constructing a 24-in. intake pipe at the city pumping station, 100 ft. into the Clearwater river. Cy clk.

Clarksburg, W. Va.—Sealed bids are asked until June 15 for constructing c. i. water pipe, valves and appurtenances and for a mechanical filter plant and appurtenances. Scott G. Highland, secy. bd. w. w. and sewerage.

CONTRACTS AWARDED.

Cherokee, Ia.—The contract for laying 3,200 ft. of c. i. water mains was awarded to Swanson & Bosworth, of Cherokee.

Albert Lea, Minn.—The contract for installing water mains was awarded to the Cook Construction Co., of Des Moines, Ia., for $2,932.

Medford, Ore.—The Jacobson-Bade Co., of Portland, Ore., was awarded the contract for constructing 6 mls. of water mains.

Tacoma, Wash.—The Anderson Construction Co. was awarded a contract for constructing water mains in the tide lands for $11,720.

O'Keene, Okla.—The contract for constructing water works system was awarded to the Southwestern Engineering Co., of Oklahoma City, for $30,000.

Utica, N. Y.—The contract for water piping for fire protection at the Utica State Hospital was awarded to John M. Holler, 452 Broadway, Albany, for $4,396.

Mont Alto, Pa.—The Pitt Construction Co., of Pittsburg, was awarded the contract May 2, for extensions to the Pa. State Mountain Sanatorium, for $19,967.

Fallstone, Md.—The contract for constructing a water works system at the Children's Fresh Air Farm was awarded to the Baltimore Cooperage Co., of Baltimore.

Willard, N. Y.—The contract for water tower and piping for fire protection at the Willard State Hospital was awarded to the Des Moines Bridge and Iron Co., of Des Moines, Ia.

Las Animas, Colo.—The contract for constructing an irrigation system for 20,000 acres adjoining Las Animas was awarded to the Kaw Construction Co., of Kansas City, Mo., for $800,000.

Boston, Mass.—(Special)—The Aberthaw Construction Co., of Boston, Mass., has been awarded the contract to erect a new reinforced concrete standpipe near the old one in Westerly, R. I. The new standpipe will be 40 feet inside diameter, nearly 100 feet from the ground to the top of the dome, and capable of holding 70 feet of water. As it is to be located in the center of the town, especial attention has been given to its architectural features.

New York City.—Bids were submitted May 11, for furnishing and constructing high pressure fire service mains and appurtenances in the Gowanus and South Brooklyn districts, as follows: Cranford Co., 52 Ninth st., Brooklyn, $497,697; Michael J. Dady, $625,042; Haggerty & Drummond, 280 Broadway, $537,338; F. V. Smith Contracting Co., $557,062; Murphy Bros., $555,217; James H. Holmes, $523,974.

Youngstown, O.—Contracts have been awarded as follows: General contract, to F. E. Dean & Co., of Youngstown, $4,789; erection of pumping station, to A. J. Serviss & Son, Youngstown, $1,656; furnishing pipe for entire system, to U. S. Cast Iron Pipe and Foundry Co., of Buffalo, $6,728; standpipe, to Tibbett & Wood, of Philipsburg, N. J., $2,891; hydrant, valves and valve boxes, to Darling Pump Mfg. Co., of Williamsport, Pa., $1,225.

Beau Bridge, La.—Contracts for constructing a water works system were awarded, May 3, as follows: To U. S. Cast Iron Pipe & Foundry Co., 71 Broadway, New York, pipe, $28.30 per ton, specials, $55; the Fairbanks Co., valves and hydrants; the R. D. Cole Mfg. Co., Newman, Ga., tower and tank, $3,595; Platt Iron Works Co., Dayton, Ohio, pump and boiler feeders, $1,534; Walsh & Weidner Boiler Co., Chattanooga, Tenn., boilers and steel setting, $1,769; Ahrens & Ott Mfg. Co., New Orleans, La., lead, hemp and general supplies.

BRIDGES.

Troy, O.—Bids are asked until June 8 for constructing bridges. A. E. Sinks, co. audt.

Stronghurst, Ill.—Bids are asked until June 4 for building 3 bridges. P. A. Stamp, twp. clk.

Philadelphia, Pa.—The business men of West Philadelphia advocate a larger bridge at Chestnut st.

Port Angeles, Wash.—Bids are asked until June 3 for building a bridge across Moose creek. Co. audt.

Greencastle, Ind.—Bids are asked until June 6 for constructing 4 bridges. D. V. Moffett, co. audt.

Valparaiso, Ind.—Bids are asked until June 7 for constructing 2 bridges. G. F. Stinchfield, engr.

Chehalis, Wash.—Bids are asked until June 4 for constructing 2 steel bridges. H. H. Snofford, co. audt.

La Salle, Ill.—Bids are asked until June 13 for constructing a concrete arch. E. Bryne, cy. engr.

Newport, Ind.—Bids are asked until June 6 for building a steel girder bridge. H. T. Payne, co. audt.

Tunica, Miss.—Bids are asked until June 6 for constructing culverts. F. L. Hose, clk. bd. co. supvrs.

Shelbyville, Ind.—Bids are asked until June 7 for constructing bridges and bridge repair. C. W. Huntington, co. audt.

Jeffersonville, Ind.—Bids are asked until June 6 for constructing a bridge over Logan creek. Peter Nachaud, co. audt.

Crookston, Minn.—Bids will be called for in June for the construction of 11 new bridges this summer. Co. audt.

Colfax, Wash.—Bids are asked until June 7 for constructing a number of bridges. Wm. M. Duncan, co. audt.

Portland, Ore.—The construction of a bridge over the Willamette river is urged by the South Portland Club.

Smithfield, N. C.—Bids are asked until June 6 for building an iron bridge. Sam T. Honeycutt, clk. co. comrs.

Madison, Ind.—Bids are asked until June 7 for constructing and repairing bridges. G. F. Crozier, co. audt.

Warren, O.—Bids are asked until June 6 for constructing a bridge over Grand river. Fred Stone, co. audt.

Farmington, Mo.—Bids are asked until June 20 for constructing a steel bridge over Blue river. C. H. Troy, co. audt.

Idaho Falls, Idaho.—Bids are asked until July 11 for constructing 2 wagon bridges across Big Lost river. Co. comrs.

Brookville, Ind.—Bids are asked until June 1 for constructing concrete arches and fills. Chas. A. Miller, co. audt.

New Castle, Ind.—Bids are asked until June 16 for constructing arches, culverts and bridges. W. L. Risk, co. audt.

Stevenson, Wash.—Bids are asked until July 5 for building a bridge over Little White Salmon river. Bd. co. comrs.

Kirkwood, N. Y.—Voted to appropriate $500 for constructing a bridge across the Susquehanna river between this town and Conklin.

Charlestown, W. Va.—The estimated cost of constructing a bridge over the Kanawha river is $95,000 to $125,000. Cy. council.

Grand Rapids, Mich.—Bids are asked until June 3 for repairs to piers at Pentwater, Mich. C. S. Ricke, major U. S. Engrs.

Hammond, Ind.—Bids are asked until June 7 for constructing 6 new bridges and a concrete arch. Chas. A. Johnson, co. audt.

Jackson, Mich.—Bids are asked until June 6 for constructing a concrete or steel bridge over Grand river. A. W. Hall, cy. engr.

Brazil, Ind.—Bids are asked until June 6 for constructing 2 concrete bridges and 1 steel bridge. Jas. L. Brown, co. audt.

Cheyenne, Wyo.—Bids are asked until June 8 for constructing a wood and timber bridge over Pole creek. C. Edward Artist, co. clk.

Winnipeg, Man.—Bids are asked until June 28 for constructing concrete piers and a steel bridge. M. Peterson, secy. bd. control.

Ft. Sill, Okla.—Bids are asked until June 10 for constructing a steel highway bridge Cache creek. Capt. David L. Stone, constr. Q. M.

Concully, Wash.—Bids are asked until June 7 for constructing a steel and wood bridge over Similkameen river at Nighthawk. Co. comrs.

Crown Point, Ind.—Bids are asked until June 6 for constructing a steel bridge across Grand Calumet river. Chas. A. Johnson, co. audt.

Vicksburg, Miss.—Bids are asked until June 7 for constructing a wooden bridge or aprons in Red Bone bottom. J. D. Laughlin, clk. co. bd. supvrs.

St. Louis, Mo.—Bids are asked until June 21 for constructing foundation and concrete work for concrete viaduct on Kings highway, from Manchester to McKee ave. Maxime Reber, prest. B. P. I.

Taylors Falls, Minn.—Bids are asked until June 3 for constructing a steel bridge across St. Croix river, between St. Croix Falls and this village. Bd. vil. trustees of St. Croix Falls; vil. coun. Taylors Falls.

Lafayette, Ind.—Bids are asked until June 8 for constructing a steel bridge across Burnett's creek at Battle Ground and for the repair of the old stone abutments; for a concrete flat top bridge across Little Flint creek. John P. Foresman, co. audt.

STREET LIGHTING.

Terre Haute, Ind.—The Citizens Gas. Co. contemplates enlarging its plant.

Palmyra, Mo.—Voted to issue $15,000 bonds to acquire or construct an electric light plant.

Camrose, Alta.—Plants for a municipal electric light plant will be prepared by M. A. Maxwell, of Boston.

Owensville, Ind.—Plans have been authorized for improving and extending the central electric light plant.

Macon, Miss.—The city council contemplates enelarging and improving the municipal electric light plant.

Cairo, Ga.—Voted to issue bonds for improvements to the electric light system. J. M. McNair, cy. clk.

Ft. Andrews, Mass.—Bids are asked until June 6 for constructing an electric light system. A. M. Miller, constr. Q. M.

Savannah, Mo.—Bids are asked until June 15 for constructing an electric light plant. F. C. Barington, St. Joseph, Mo.

Ft. McKinley, Me.—Bids are asked until June 2 for remodeling the electric light system here. Capt. C. F. Humphrey, constr. Q. M.

Elkton, Md.—Plans for constructing an electric power plant are being considered by the Elkton, Fair Hill and Oxford Electric Ry. Co.

West Palen Beach, Fla.—Bids are asked until July 1 for constructing an electric light plant. G. W. Jonas, secy. West Palen Beach Impvt. Co.

Bedford, Ind.—The White River Power Co. has been incorporated to deal in electric current, by John T. Freeland, John M. Monical and Milt Myers.

Sullivan, Ind.—The Sullivan Electric Co. has approved plans and bids will be received for remodeling a large warehouse into an electric light and power plant.

New Market, Ind.—The New Market Light Co. has been incorporated to conduct light, heat and power business, by W. V. Yount, W. J. Miles and L. B. Etter.

Old Town, Me.—A special committee has been appointed to inquire into the feasibility of establishing a municipal electric light plant. Wm. H. Waterhouse, McLeod Bldg.

Victoria, B. C.—Bids are asked until June 6 for constructing a transmission line for furnishing electricity to the hospital for the insane at Coquitlam. Minister Pub. Wks.

Cisco, Utah.—Bids are asked until June 30 for constructing a power plant for irrigation purposes for the Grand Valley Fruit and Water Co. to be constructed here. Hampson-Fielding Engrg. Co., Engrs., Denver, Colo.

GARBAGE DISPOSAL, STREET CLEANING AND SPRINKLING.

Rock Island, Ill.—The purchase of a street sprinkler is contemplated.

Toledo, O.—Bids are asked until June 10 for the disposal of garbage. Dir. pub. service.

Rochester, N. Y.—The question of constructing a crematory for the disposal of rubbish is contemplated.

White Plains, N. Y.—Bids are asked until June 6 for collecting garbage for 1 year. John J. Brown, prest. town trustees.

PARKS.

Kansas City, Mo.—Arleta Park is to be enlarged.

Boston, Mass.—Marine Park, in South Boston, is to be improved and beautified.

Bloomfield, N. J.—The establishment of a park in the 2nd ward is contemplated.

Augusta, Ga.—May Park is to be restored to its former state of beautiful usefulness.

FIRE APPARATUS.

Hillyard, Wash.—The city clerk has been directed to ask for bids for a fire alarm system.

Eveleth, Minn.—Bids are asked until June 7 for 200 ft. 2½-in. rubber lined fire hose. D. P. McIntyre, cy. clk.

Virginia, Minn.—Bids are asked until June 6 for 1,000 ft. of 2½-in. cotton rubber lined hose. Albert E. Bickford, secy. police and fire comm.

St. Paul, Minn.—Bids are asked until June 14 for purchasing a 2nd size steam fire engine. The chief engineer recommends the purchase of a combination hose wagon. Wm. O'Gownan, secy. fire bd.

Montgomery, Ala.—Bids are asked until June 6 for 2 steam fire engines, Nos. 1 and 2; 2 combination chemical and auto hose cars; 600 ft. 2½-in. rubber and cotton hose. Robt. Tait, cy. treas.